KACO new energy.

blueplanet
3.0 TL1 | 3.5 TL1
3.7 TL1 | 4.0 TL1
4.6 TL1

Operating Instructions

■ **English translation of German original**

Operating Instructions

for Installation Engineers and Operators

EN

Contents

1 General information 4
1.1 About this document 4
1.2 Layout of Instructions 4
2 Safety 5
2.1 Proper use 6
2.2 Protection features 6
2.3 Trademark 6
2.4 Additional information 6
3 Description 7
3.1 Mode of Operation 7
3.2 Diagram 7
4 Technical Data 10
4.1 Electrical Data 10
4.2 Mechanical data 12
5 Transportation and Delivery 13
5.1 Delivery 13
5.2 Transportation 13
6 Mounting 14
6.1 Unpacking 16
6.2 Mounting 17
7 Installation 18
7.1 Opening the connection area 18
7.2 Making the electrical connection 20
7.3 Connecting the PV generator 22
7.4 Connecting the interfaces 24
7.5 Sealing the connection area 27
7.6 Starting up the inverter 28
8 Configuration and Operation 29
8.1 Controls 29
8.2 Initial start-up 32
8.3 Menu structure 32
8.4 Monitor inverter 40
8.5 Performing the software update 42
9 Maintenance/Troubleshooting 43
9.1 Visual inspection 43
9.2 Cleaning 43
9.3 Shutting down for maintenance and troubleshooting 44
9.4 Faults 44
9.5 Messages on the display and the "Fault" LED 46
10 Service 50
11 Shutdown/Disassembly 51
11.1 Shutdown 51
11.2 Uninstallation 51
11.3 Disassembly 52
12 Disposal 52
13 EU Declaration of Conformity 53

EN

1 General information

1.1 About this document

WARNING

Improper handling of the inverter can be hazardous

› You must read and understand the operating instructions before you can install and use the inverter safely.

1.1.1 Other applicable documents

During installation, observe all assembly and installation instructions for components and other parts of the system. These instructions also apply to the equipment, related components and other parts of the system.

Some of the documents which are required for the registration and approval of your photovoltaic (PV) system are included with the operating instructions.

1.1.2 Storing the documents

These instructions and other documents must be stored near the system and be available at all times.

1.2 Layout of Instructions

1.2.1 Symbols used

General hazard

Risk of fire or explosion

High voltage

Risk of burns

Authorised electrician Only authorised electricians are permitted to carry out tasks indicated with this symbol.

1.2.2 Safety warnings symbols guide

DANGER

High risk

Failure to observe this warning will lead directly to serious bodily injury or death.

WARNING

Potential risk

Failure to observe this warning may lead to serious bodily injury or death.

CAUTION

Low-risk hazard

Failure to observe this warning will lead to minor or moderate bodily injury.

CAUTION

Risk of damage to property

Failure to observe this warning will lead to property damage.

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1.2.3 Additional information symbols

NOTE

Useful information and notes

EN	**Country-specific function**
	Functions restricted to one or more countries are labelled with country codes in accordance with ISO 3166-1.

1.2.4 Instructions symbols guide

Instructions

- ↻ Prerequisites before carrying out the following instructions
- ☞ Carry out step.
- ☞ (Additional steps, if applicable)
- » Result of the step(s) (optional)

2 Safety

DANGER

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death if the cables and/or terminals in the inverter are touched.

The inverter is only permitted to be opened and serviced by an authorised electrician.

› Keep the inverter closed when the unit is in operation.

› Do not make any modifications to the inverter.

The electrician is responsible for observing all existing standards and regulations.

- Keep unauthorised persons away from the inverter and PV system.
- In particular, be sure to observe IEC-60364-7-712:2002 "Requirements for special types of business premises, rooms and installations - Solar-Photovoltaic-(PV) Power Supply Systems.
- Ensure operational safety by providing proper grounding, conductor dimensioning and appropriate protection against short circuiting.
- Observe all safety instructions on the inverter and in these operating instructions.
- Switch off all voltage sources and secure them against being inadvertently switched back on before performing visual inspections and maintenance.
- When taking measurements while the inverter is live:
  - Do not touch the electrical connections.
  - Remove all jewellery from your wrists and fingers.
  - Ensure that the testing equipment is in safe operating condition.
- Stand on an insulated surface when working on the inverter.
- Modifications to the surroundings of the inverter must comply with the applicable national and local standards.
- When working on the PV generator, it is also necessary to switch off the DC voltage with the DC isolator switch in addition to disconnecting the PV generator from the grid.

EN

2.1 Proper use

The inverter converts the DC voltage generated by the PV modules into AC voltage and feeds it into the grid. The inverter is built according to the latest technological standards and safety regulations. Nevertheless, improper use may cause lethal hazards for the operator or third parties, or may result in damage to the unit and other property.

Operate the inverter only with a permanent connection to the public power grid.

Any other or additional use of the device is not considered intended use. This includes:

- Mobile use,
- Use in potentially explosive atmospheres,
- Use in rooms where the humidity is higher than 95%,
- Operation outside the specifications intended by the manufacturer,
- Islanding operation.

2.2 Protection features

For your safety, the following monitoring and protective functions are integrated into inverters:

- Overvoltage conductors/varistors to protect the power semiconductors from high-energy transients on the grid and generator side,
- Temperature monitoring of the semiconductor,
- EMC filters to protect the inverter from high-frequency grid interference,
- Grid-side grounded varistors to protect the inverter against burst and surge pulses,
- Islanding detection according to the current standards.

2.3 Trademark

The software of the inverter uses the MD5 Message Digest algorithm of RSA Data Security, Inc. The devices uses the open source operating system FreeRTOS 7.00.

2.4 Additional information

NOTE

The EU Declaration of Conformity can be found in the appendix. For information on grid coupling, grid protection and safety parameters along with more detailed instructions see our web site at http://www.kaco-newenergy.de/.

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3 Description

3.1 Mode of Operation

The inverter converts the DC voltage generated by the PV modules into AC voltage and feeds it into the grid. The feed-in process begins when there is sufficient sunlight and a specific minimum voltage is present in the inverter. If, as it gets dark, the voltage drops below the minimum voltage value, the feed-in mode ends and the inverter switches off.

3.2 Diagram

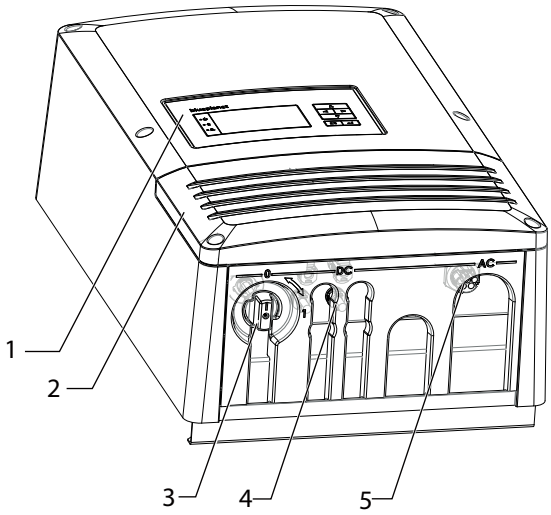


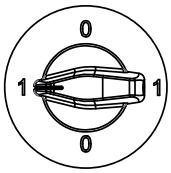
Figure 1: Inverter diagram

Key			
1	Control panel	4	DC connection (DC connector)
2	Cover for the connection area	5	AC connection (5-pole connector)
3	DC isolator switch		

3.2.1 Mechanical components

DC isolator switch

The DC isolator switch is located on the underside of the inverter. The DC isolator switch is used to disconnect the inverter from the PV generator in order to carry out service.



Disconnecting the inverter from the PV generator

☞ Switch the DC isolator switches from 1 (ON) to 0 (OFF).

Connecting the inverter to the PV generator

☞ Switch the DC isolator switches from 0 (OFF) to 1 (ON).

3.2.2 Electrical functions

Fault signal relay/Priwatt

A potential-free relay contact is integrated in the inverter. Use this contact for one of the following functions:

Fault signal relay

The potential-free relay contact closes as soon as there is a fault during operation. You use this function, for example, to signal a fault visually or acoustically.

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Priwatt

The energy that is provided by the PV system can be put to use directly by the appliances that are connected in your home. In Priwatt mode, the potential-free contact takes care of this function.

The potential-free contact switches larger appliances (e.g. air conditioning units) on and off. This requires an external power supply (max. 30 V DC) and an external load relay. Both can be obtained as part of the Priwatt-switch from your specialist retailer.

When the function is active, either the remaining runtime (in hours and minutes) or the shutdown threshold (in kW) is displayed on the start screen depending on the operating mode selected. The "Priwatt" function is not active in the unit's factory default state. The option can be configured in the Settings menu.

3.2.3 Interfaces

You configure the interfaces and the web server in the Settings menu.

The inverter has the following interfaces for communication and remote monitoring:

Ethernet interface

Monitoring can occur directly on the unit using the integrated Ethernet interface. A local web server is installed in the unit for this purpose.
For monitoring a system comprising several inverters, we recommend you use an external data logging and monitoring system.

RS485 interface

Use this monitoring option if you cannot check the functioning of the system on-site on a regular basis, e.g. if your place of residence is located a great distance from the system. To connect the RS485 interface, contact your authorised electrician.

For monitoring your PV system using the RS485 interface, KACO new energy GmbH offers monitoring devices:

Only the RS485 interface continues to transmit data if the inverter in an inverter group fails.

USB interface

The USB connection of the inverter is a type A socket. It is located on the connection circuit board behind the cover for the connection area. The USB connection is specified to draw 100 mA of power. Use the USB interface for reading out stored operating data and loading software updates using a FAT32-formatted USB stick.

"Inverter Off" input

If Powador protect is installed as a central grid and system protection, the fail-safe disconnection of suitable Powador or blueplanet inverters from the public grid can be initiated by a digital signal instead of tie circuit-breakers. This requires the inverters in the photovoltaic system to be connected to the Powador protect. For information on the installation and use see this manual, the Powador protect manual and the instructions for use of the Powador protect on the KACO new energy website.

S0 interface (optional)

The S0 interface transmits pulses between a pulsing counter and a tariff metering unit. It is a galvanically isolated transistor output. It is designed according to DIN EN 62053-31:1999-04 (pulse output devices for electromechanical and electronic meters).

The S0 interface pulse rate can be chosen in three unit intervals (500, 1,000 and 2,000 pulses/kWh).

The optional interface card is available from the service department of KACO new energy.

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3.2.4 KACO inverter as part of a PV system

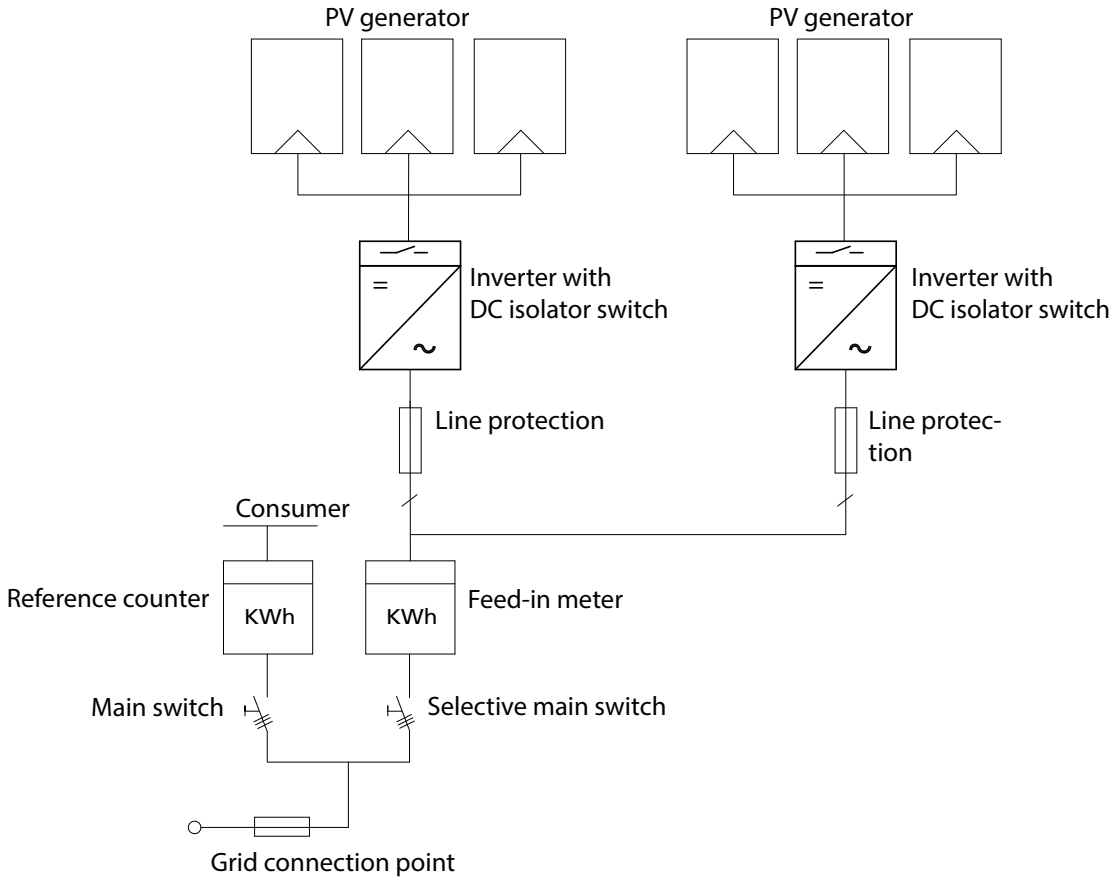

Figure 2: Circuit diagram of a system with two inverters

Summary of the components

PV generator

The PV generator, i.e. the PV modules, converts the radiant energy of sunlight into electrical energy.

DC connection

The PV generator is connected directly to the inverter's DC connection. The DC connection can be used to connect two strings.

DC isolator switch

Use the DC isolator switch to disconnect the inverter from all power sources on the PV generator side.

Grid fuses

Use only specific PV rated fuses.

Feed-in meter

The feed-in meter is specified and installed by the power supply company. Some power supply companies also allow the installation of your own calibrated meters.

Selective main switch

If you have any questions about the selective main switch, contact your power supply company.

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4 Technical Data

4.1 Electrical Data

Product: KACO blueplanet	3.0 TL1 M1	3.0 TL1	3.5 TL1
Input levels			
DC MPP range from [V] to [V]*	280 ... 510	150 ... 510	165 ... 510
Operating range from [V] to [V]		125 ... 550	
Starting voltage [V]**		150	
Open circuit voltage [V]		600	
Rated current max. [A]	11	2 x 11	2 x 11
Max. power per tracker [W]	3100	3100	3600
Number of strings	1	2	2
Number of MPP controls	1	2	2
Max. short-circuit current [A]		25	
Polarity safeguard		Short-circuit diode	
Overvoltage protection class/category		III / II	

*At DC voltages below the MPP range the maximum rated current reduces the maximum DC rated power.

**For PV generators with MPP voltages below the MPP range of the inverter, the start voltage can be set in the menu.

Output levels			
Rated power [VA]	3000	3000	3450
Grid voltage [V]		230 (1/N/PE)	
Rated current [A]	13.0	13.0	15.0
Rated frequency [Hz]		50	
cos phi		1 – 0.3 (ind/cap)	
Number of feed-in phases		1	
Distortion factor [%]		5.5	
Overvoltage protection class/category		III / III	
General electrical data			
Max. efficiency [%]	97.2	97.2	97.2
European efficiency [%]	96.5	96.6	96.7
Make current [A] and ON duration [ms]		1.82	
Internal consumption: night [W]		<4	
Feed-in starts at [W]		20	
Circuit design		Transformerless	
Grid monitoring		Country-specific	
Ground fault monitoring		Yes	

Product: KACO blueplanet	3.7 TL1	4.0 TL1	4.6 TL1
Input levels			
DC MPP range from [V] to [V]*	170 ... 510	185 ... 510	215 ... 510
Operating range from [V] to [V]		125 ... 550	
Starting voltage [V]**		150	
Open circuit voltage [V]		600	
Rated current max. [A]		2 x 11	
Max. power per tracker [W]	3800	4100	4700
Number of strings		2	
Number of MPP controls		2	
Max. short-circuit current [A]		25	
Polarity safeguard		Short-circuit diode	
Overvoltage protection class/category		III / II	

*At DC voltages below the MPP range the maximum rated current reduces the maximum DC rated power.

**For PV generators with MPP voltages below the MPP range of the inverter, the start voltage can be set in the menu.

Output levels			
Rated power [VA]	3680	4000	4595
Grid voltage [V]		230 (1/N/PE)	
Rated current [A]	16.0	17.5	20.0
Rated frequency [Hz]		50	
cos phi		1 – 0.3 (ind/cap)	
Number of feed-in phases		1	
Distortion factor [%]		5.5	
Overvoltage protection class/category		III / III	
General electrical data			
Max. efficiency [%]	97.2	97.2	97.2
European efficiency [%]	96.7	96.7	96.8
Make current [A] and ON duration [ms]		1.82	
Internal consumption: night [W]		<4	
Feed-in starts at [W]		20	
Circuit design		Transformerless	
Grid monitoring		Country-specific	
Ground fault monitoring		Yes	

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4.2 Mechanical data

Product: KACO blueplanet	3.0 TL1 M1	3.0 TL1	3.5 TL1 - 4.6 TL1
Display	Graphical LCD, 3 LEDs		
Controls	4-way button + 2 buttons		
Interfaces	2x Ethernet, USB, RS485 optional via interface card: S0, 4-DI, 4-D0		
Fault signal relay	Potential-free NO contact, max. 230 V/1 A		
AC connection	5-pole connector		
DC connections	SUNCLIX connector		
Ambient temperature range [°C]	-25 ... +60, derating from +40		
Humidity range (non-condensing) [%]	0 ... 95		
Maximum installation elevation [m above sea level]	2,000		
Temperature monitoring	Yes		
Cooling: free convection (K) / fan (L)	No fan natural convection		Maintenance-free interior fan
Protection rating according to EN 60529	IP54		
Degree of contamination	2		
Noise emission [dB(A)]	< 35		
DC isolator switch	Built-in		
Housing	Plastic (ASA/PC), aluminium		
H x W x D [mm]	560 x 367 x 225		
Total weight [kg]	15	16.5	18

Table 1: Mechanical data

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5 Transportation and Delivery

5.1 Delivery

Every inverter leaves our factory in proper electrical and mechanical condition.
Special packaging ensures that the units are transported safely. The shipping company is responsible for any transport damage that occurs.

Scope of delivery

- 1 inverters
- 1 installation kit
- 1 documentation set

Checking your delivery

1. Inspect your inverter thoroughly.
2. Immediately notify the shipping company in case of the following:
   - Damage to the packaging that indicates that the inverter may have been damaged,
   - obvious damage to the inverter.
3. Send a damage report to the shipping company immediately.

The damage report must be delivered to the shipping company in writing within six days of receiving the inverter.
We will be glad to help you if necessary.

5.2 Transportation

WARNING

Impact hazard, risk of breakage to the inverter

› Pack the inverter securely for transport.
› Carefully transport the inverter using the the carrying handles of the boxes.
› Do not subject the inverter to shocks.

For safe transportation of the inverter, use the holding openings in the carton.

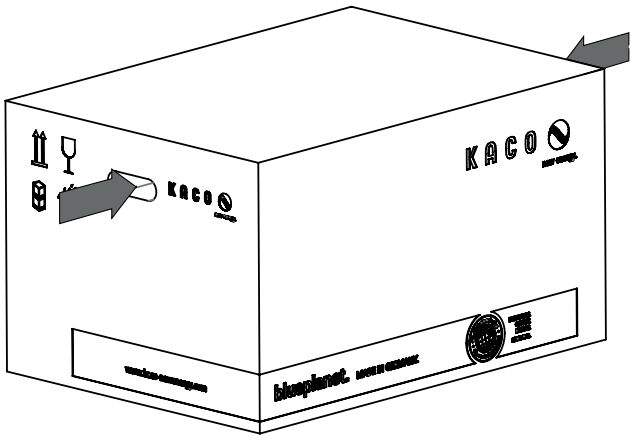

Figure 3: Transportation of the inverter

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6 Mounting

DANGER

Risk of fatal injury from fire or explosions

Fire caused by flammable or explosive materials in the vicinity of the inverter can lead to serious injuries.

› Do not mount the inverter in an area at risk of explosion or in the vicinity of highly flammable materials.

CAUTION

Risk of burns from hot housing components.

Coming into contact with the housing can cause burns.

› Mount the inverter so that it cannot be touched unintentionally.

Installation space

- As dry as possible, climate-controlled, with the waste heat dissipated away from the inverter,
- Unobstructed air circulation,
- When installing the unit in a control cabinet, provide forced ventilation so that the heat is sufficiently dissipated,
- Access to the inverter must also be possible without additional tools,
- For outdoor installation, fit the inverters in such a way to ensure that they are protected against direct sunlight, moisture - and dust penetration,
- For easy operation, ensure during installation that the display is slightly below eye level.

Wall

- With sufficient load-bearing capacity,
- Accessible for installation and maintenance,
- Made from heat-resistant material (up to 90 °C),
- Flame resistant,
- Minimum clearances to be observed during assembly: see Figure 8 on page 17.

NOTE

Access by maintenance personnel for service

Any additional costs arising from unfavourable structural or mounting conditions shall be billed to the customer.

CAUTION

Property damage due to gases that have an abrasive effect on surfaces when they come into contact with ambient humidity caused by weather conditions
The inverter housing can be severely damaged by gases (ammonia, sulphur, etc.) if it comes into contact with ambient humidity caused by weather conditions.

If the inverter is exposed to gases, it must be mounted so that it can be seen at all times.

› Perform regular visual inspections.

› Immediately remove any moisture from the housing.

› Take care to ensure sufficient ventilation of the inverter.

› Immediately remove dirt, especially on vents.

› Failure to observe these warnings may lead to inverter damage which is not covered by the KACO new energy GmbH manufacturer warranty.

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NOTE

Power reduction due to heat accumulation.

If the recommended minimum clearances are not observed, the inverter may go into power regulation mode due to insufficient ventilation and the resulting heat build-up.

› Maintain minimum clearances.

› Ensure sufficient heat dissipation.

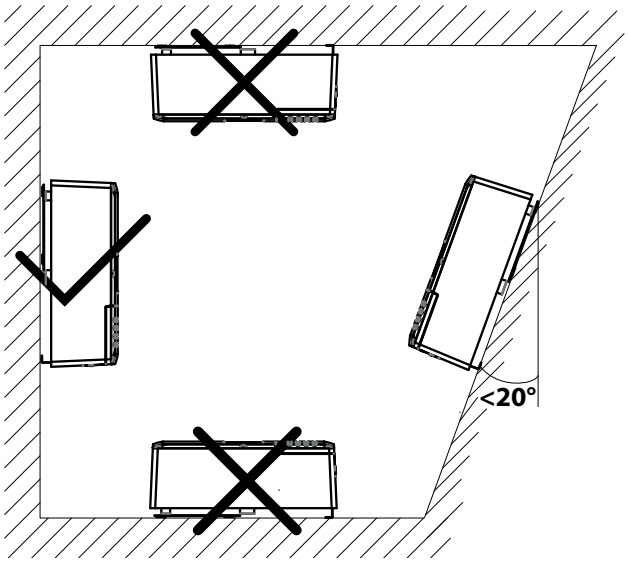

Figure 4: Instructions for wall mounting

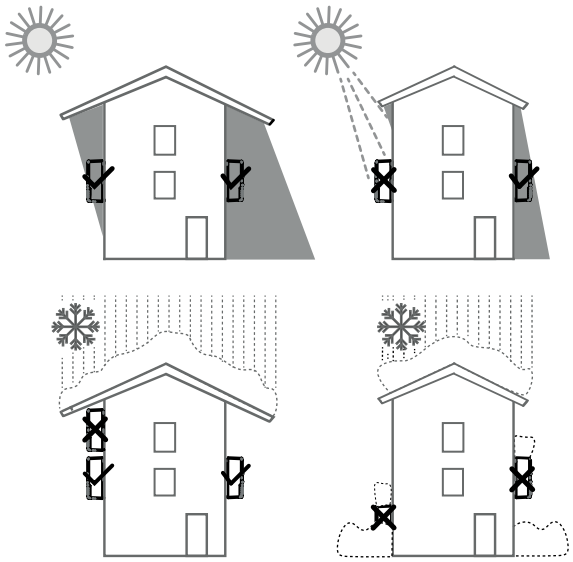

Figure 5: Inverter for outdoor installation

CAUTION

Use suitable mounting parts.

› Use only the supplied mounting parts.

› Mount the inverter upright on a vertical wall only.

› For a free-standing mounting an incline of 20° is allowed.

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6.1 Unpacking

CAUTION

The inverter is very heavy – risk of injury!

- Please pay attention to the weight, higher centre of gravity and areas for lifting the unit.
- Select suitable mounting location and mounting base.
- Use mounting material corresponding to or included with the base for mounting the inverter.
- The inverter should be always carried by 2 people.

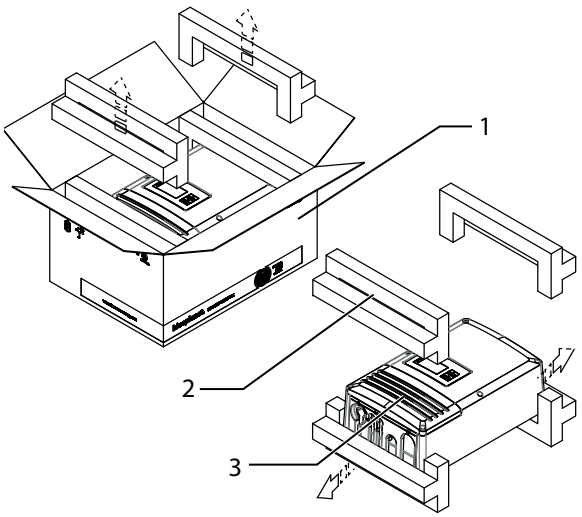

Figure 6: Unpacking the inverter

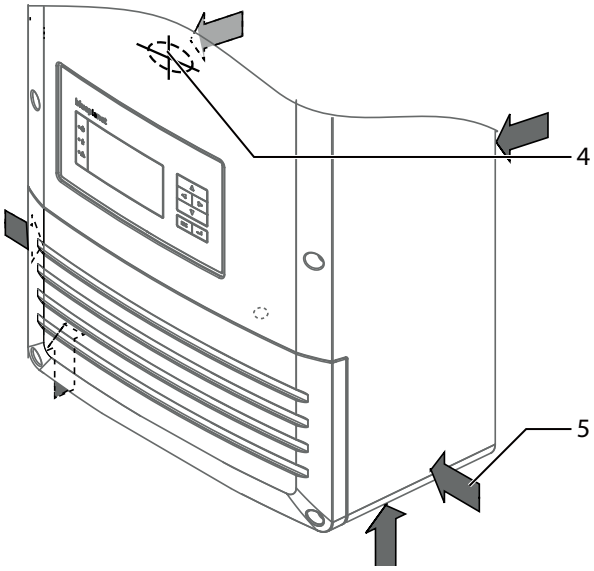

Figure 7: Lifting the inverter

Key

1	Carton	4	Centre of gravity of the inverter
2	Protective packaging	5	Areas for lifting the unit
3	Inverter		

Unpacking the inverter

1. Open carton at the front.
2. Remove installation material and documentation.
3. To take out the inverter, break the upper protective packaging from the side outwards.
4. Take out the Inverter together with the bottom protective packaging of the carton.
5. Remove the protective packaging from the unit and place back into the carton.
6. Lift the inverter from the provided areas (see Figure 7).

» Continue mounting the inverter.

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6.2 Mounting

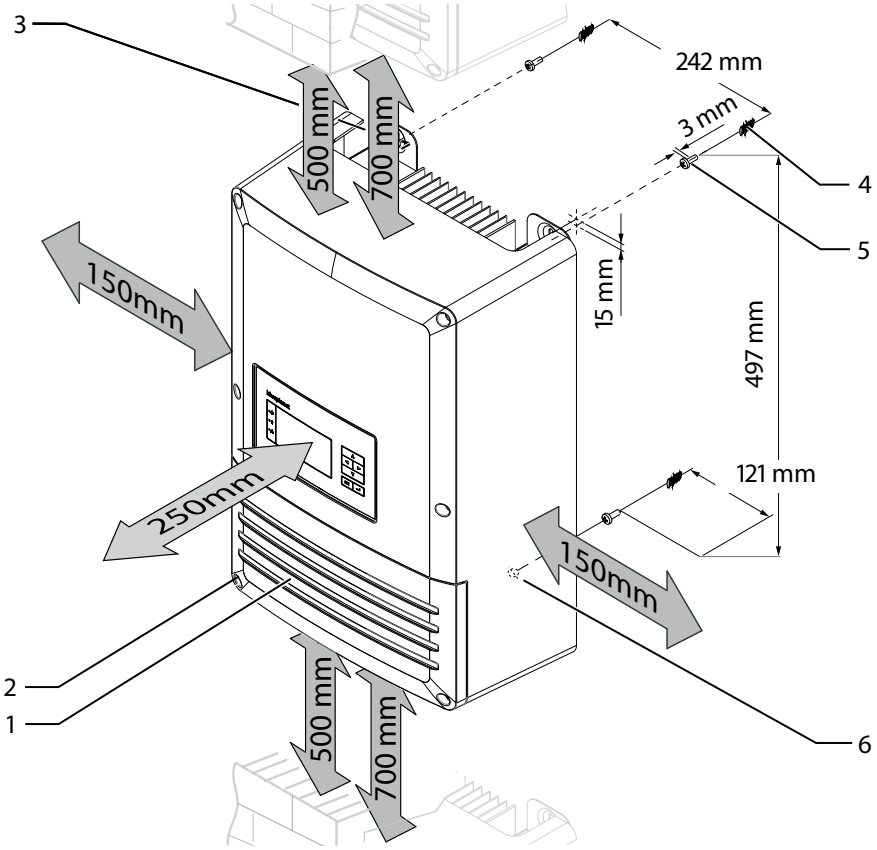

Figure 8: Minimum distances/mounting of inverter

Key

1	Cover for the connection area	4	Nozzle (x3)
2	Screws for mounting (x2 Torx)	5	Screws for mounting (x3)
3	Suspension brackets	6	Hole for securing the inverter

Mounting the inverter

1. Mark the position of the upper boreholes on the wall in accordance with the dimensions in Fig. 8 or using the suspension brackets on the back of the housing.
2. **NOTE:** Observe the minimum clearances between inverters (700 mm), or the inverter and the ceiling/floor (500 mm) as well as the side clearances (150 mm and 250 mm).
3. Fit wall plugs.
4. Screw in the top screws for assembly in accordance at the specified distance (3 mm) from the wall.
5. Suspend the inverters on the suspension brackets from the screws.
6. Unscrew and remove the fixing screws from the cover of the connection area.
7. Lower the cover of the connection area.
8. **Variant 1:** Mark the position of the bottom hole.
9. Remove the inverter and fit wall plug to secure the inverter.
10. Fit the inverters back onto the top screws and fasten to the wall using the bottom screw.
11. **Variant 2:** Remove the slider. (See Figure 11 on page 18)
12. Drill hole according to dowel size and mount on the wall by fastening screw.
13. Insert slider.
14. Fit the cover onto the housing.
15. Screw in the screws to fasten the cover.
16. The mounting of the inverter is complete. Continue with the installation.

Authorised electrician

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7 Installation

DANGER

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

Only appropriately qualified and authorised electricians may open and install the inverter.

The inverter must be mounted in a fixed position before being connected electrically.

- Observe all safety regulations and current technical connection specifications of the responsible power supply company.
- Disconnect the AC and DC sides.
- Secure both sides against being inadvertently switched back on.
- Ensure that the AC and DC sides are completely isolated and voltage free.
- Connect the inverter only after the aforementioned steps have been taken.

7.1 Opening the connection area

NOTE

Only remove the cover for the connection area (blue). Opening the housing cover (grey) will invalidate the warranty.

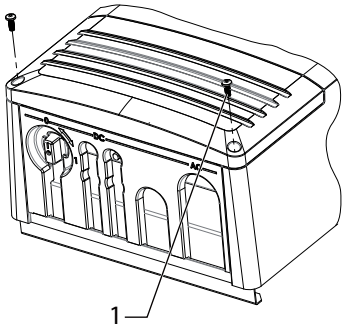

Figure 9: Disassemble the cover

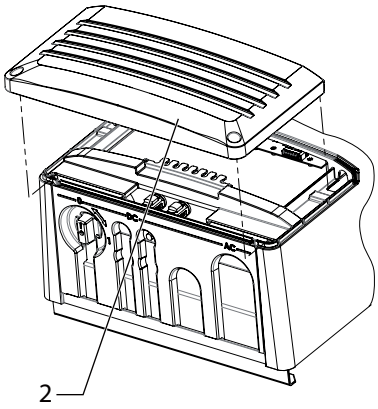

Figure 10: Remove the cover

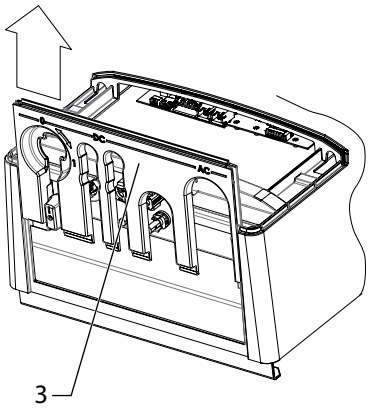

Figure 11: Remove the slider

Key			
1	Screws for mounting (x2)	3	Slider
2	Cover for the connection area		

Opening the connection area

↻ You have mounted the inverter on the wall.

1. Set the DC isolator switch to "OFF".
2. Unscrew and remove the screws for fixing on the cover for the connection area.
3. Pull the cover downwards.
4. Pull the slider out and upwards.

» Configure AC connector for connection.

⚠ Authorised electrician

7.1.1 Configuring the AC connector

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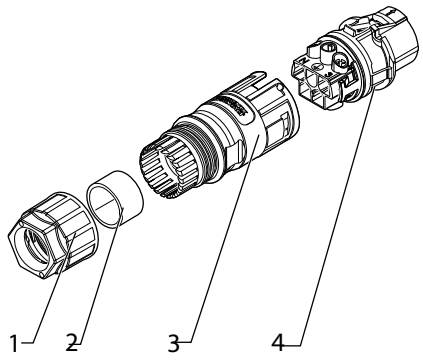

Figure 12: AC connector

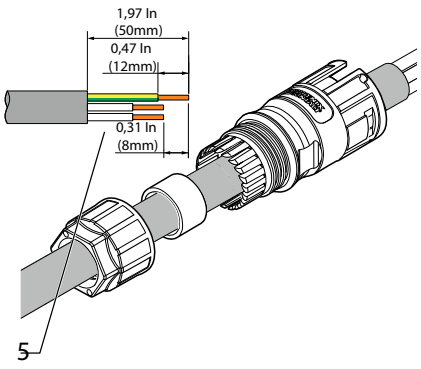

Figure 13: Remove cable insulation

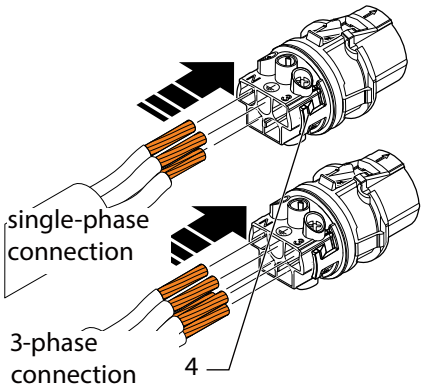

Figure 14: Connect wires to the contact carrier

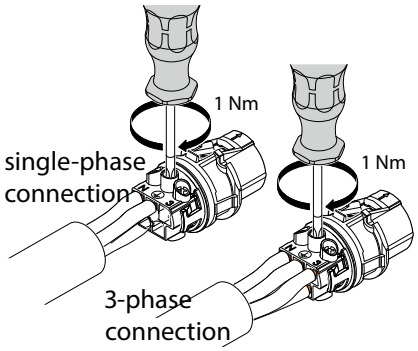

Figure 15: Tighten screws

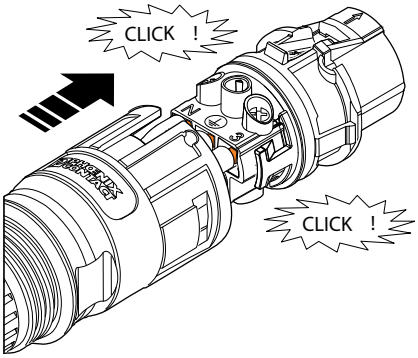

Figure 16: Press contact carrier into the housing

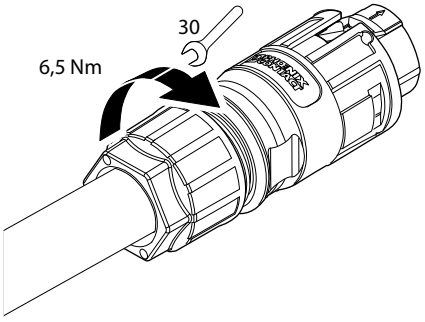

Figure 17: Tighten the cable screw fitting

Key

1	cable fitting	4	Contact plug
2	Seal	5	Cable lengths
3	Housing		

NOTE

If your grid operator or power supply company requests 3-phase power monitoring, a 3-phase (five-pin) power supply is required. The 3-phase monitoring must be also activated in the „Parameters“ menu (see Chapter 8.3 on page 32). Before installation, ask your grid operator or power supply company about the necessary grid connection.

Configuring the AC connector

↻ Connection area opened.

1. Slide the cable fitting over the cable.
2. Select seal according to cable diameter used (8 ... 12 mm/ 12 ... 16 mm/ 16 ... 21 mm).

☞ Slide the housing and seal over the cable.

3. Remove 50 mm of the outer cladding.
4. Shorten the wires N, L1 by 8 mm if a single-phase connection is present or shorten the wires N, L1, L2, L3 by the same length in case of a 3-phase connection.
5. Strip the wires N, L1 by 12 mm if a single-phase connection is present or shorten the wires N, L1, L2, L3 by the same length in case of a 3-phase connection.

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6. Flexible wires must be fitted with wire sleeves in accordance with DIN 46228.
7. Insert wires into the contacts in accordance with the markings on the contact carrier.
8. Tighten the screws on the contact carrier with 1 Nm.
9. Press contact carriers into the housing with an audible "click".
10. Secure the housing with no. 30 open wrench.
    Tighten the cable fitting using a torque of 6.5 Nm.

» Make the electrical connections.

7.2 Making the electrical connection

Make the connection for the PV generator and grid connection to the underside of the housing via the connector.

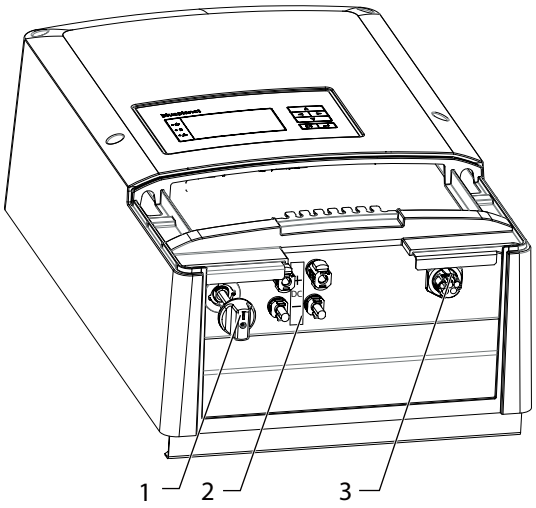

Figure 18: Connection area: electrical connection

Key			
1	DC isolator switch	3	Device connector
2	DC connector for PV generator		

7.2.1 Connecting the inverter to the power grid

The power connection wires are connected on the right of the connection area (see Figure 18 on page 20).

⚠ **DANGER**

Risk of fatal injury due to electric shock

Severe injury or death will result if the live connections are touched.

› Disconnect the inverter completely from all power sources before connecting up to the grid.

› Make sure that the device is isolated from the public power supply and the system power supply before starting work.

Recommended conductor cross-sections and fuse protection of NYM cables for fixed wiring according to VDE 0100 part 430

For cable lengths up to 20m, use the specified conductor cross-sections. Longer cable lengths require larger conductor cross-sections.

Model	Conductor cross-section	Fuse protection: gL safety fuses or comparable automatic circuit breakers
KACO blueplanet 3.0-4.6 TL1	6.0 mm²	25 A for 4.0 mm² conductor cross-section

Table 2: Recommended conductor cross-sections and fuse protection of NYM cables

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NOTE

When the line resistance is high (i.e. long grid-side cables), the voltage at the grid terminals of the inverter will increase during feed-in to the grid. The inverter monitors this voltage.
If the voltage exceeds the country-specific grid overvoltage limit value, the inverter switches off.

› Ensure that the conductor cross-sections are sufficiently large or that the cable lengths are sufficiently short.

Making the grid connection

↻ AC connector configured.

1. Connect the configured plug connectors to the device connector by fitting into place.
2. Lay the lead correctly and in accordance with the following rules:
   – Distance of the cable to the housing greater than 20 cm
   – Cable not via semiconductor
   – Excessive bending force may negatively impact the protection rating. Lay the lead with a bending radius of at least 4 times the cable diameter.

» The inverter is now connected to the power grid.

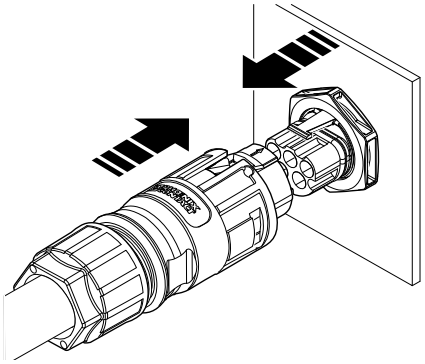

Figure 19: Engage the AC connector with the device connector.

NOTE

An AC-side disconnection unit must be provided during the final installation stage. This disconnection unit must be installed so that it can be accessed at any time without obstruction.

If a residual current circuit breaker is necessary due to the installation specification, a type A residual current circuit breaker must be used.

7.2.2 Disconnecting the AC connector

DANGER

Risk of fatal injury due to electric shock

Never disconnect the connector under load.

› Disconnect the inverter completely from all power sources before disconnecting the AC connector.

› Make sure that the device is isolated from the public power supply and the system power supply before starting work.

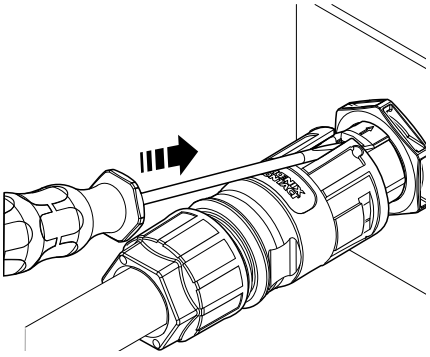

Figure 20: Disconnect the AC connector from the device connector

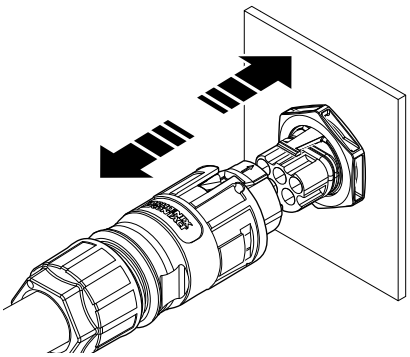

Figure 21: Disconnect the AC connection

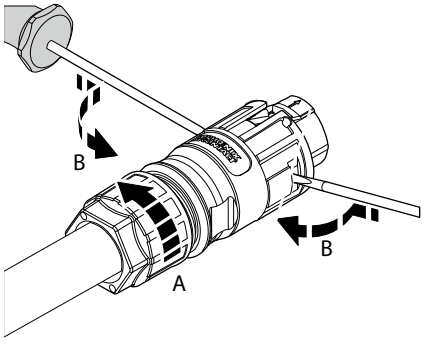

Figure 22: Unfasten the cable

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Disconnecting the AC connection

↻ Ensure there is no AC/DC voltage present.

1. Use a screwdriver (blade with 3.5mm) to press the tab on the housing downwards.
2. Unlock the plug connection.
3. Unscrew the cable fitting.
4. Use a screwdriver to unlock the contact carrier on both sides.
5. Remove the contact carrier from the housing.
6. Unfasten and remove the screws on the contact carrier.

7.3 Connecting the PV generator

Connect the PV generator to the DC positive and the DC negative connection plugs on the underside of the housing (see Figure 23).

DANGER

Risk of fatal injury due to the grounding of the connected PV modules!

› For the connection from this transformerless TL1 inverter, grounding on the PV modules or strings is prohibited in accordance with IEC62109-1 §5.3.1.

NOTE

In accordance with IEC 61730 Class A, connected PV modules must be dimensioned for the DC system voltage provided, and at least for the value of the AC grid voltage.

DANGER

Risk of fatal injury due to contact voltages.

› During installation: Electrically disconnect the DC positive and DC negative from the protective earth (PE).

› Disconnect the inverter from the PV generator using the integrated DC isolator switch.

› Remove the plug connector.

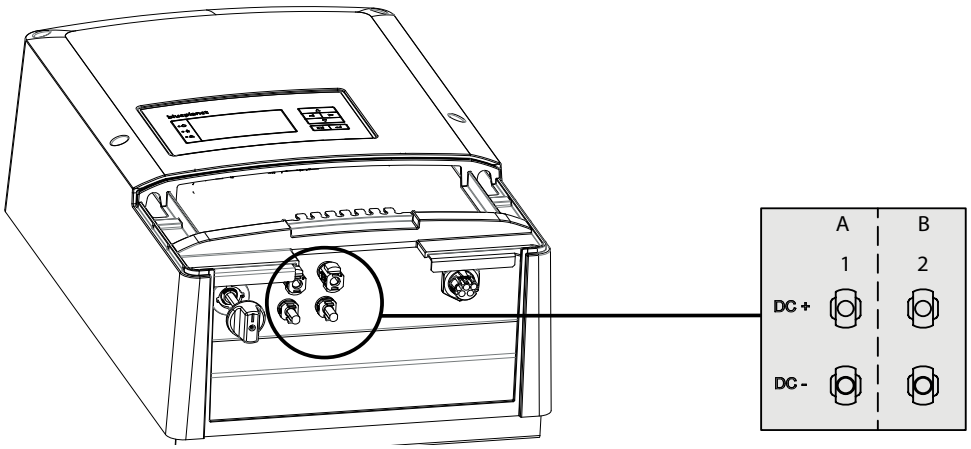

Figure 23: Connections for DC positive and DC negative

Key			
A	MPP tracker A	B	MPP tracker B
1	DC plus/DC minus connection	2	DC plus/DC minus connection

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7.3.1 Before connecting

Ensure that there is no ground fault

1. Determine the DC voltage and resistance on the PV generator for:
   - protective earth (PE) and positive cable
   - protective earth (PE) and negative cable

If stable voltages can be measured, there is a ground fault in the DC generator or its wiring. The ratio between the measured voltages gives an indication as to the location of this fault.

In addition, ensure that the PV generator has a total insulation resistance of more than 2.0 MOhm, since the inverter will not feed in if the insulation resistance is too low.

2. Rectify any faults before connecting the DC generator.

7.3.2 Maximum input power

The input power of the inverter is limited only by the maximum rated current per input. This causes the maximum input power per path to increase with the input voltage.

NOTE

The overall power of the unit continues to be limited. If one input is connected to more than P(DCmax)/2, the maximum input power of the second input decreases accordingly. Take care that the maximum input power is not exceeded.

7.3.3 Recommended connections

DANGER

Risk of fatal injury due to electric shock (electric arc)!

Wrong assignment of MPP trackers will seriously damage the inverter

Severe injury or death will result if the live connections are touched.

› Make sure that each MPP tracker can be disconnected from all poles.

› Observe recommended standard connection.

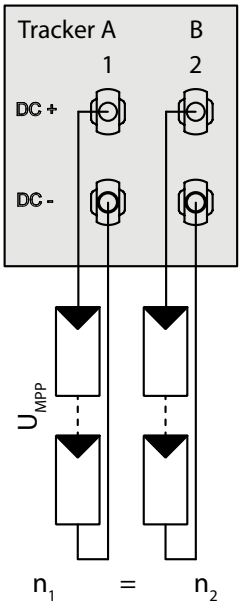

Figure 24: Recommended standard connection

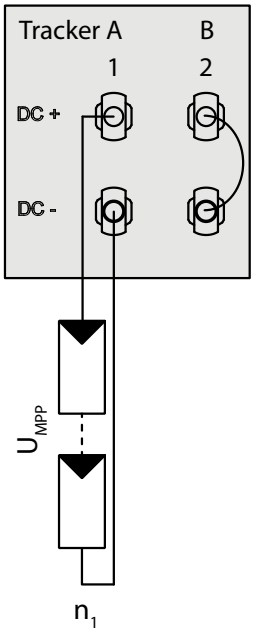

Figure 25: Connection with unused MPP tracker B

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Electrical data for	standard connection	Non-use of an MPP tracker B
Connecting the DC inputs	Number of modules per string: $n_1=n_2$	Number of modules per string: $n_1=n_2=n_m$
P_{max}	per string < 4.7 kW	per string < 0.5 * max. recommended PV generator power P_{max} on the MPP tracker used < max. power per tracker
I_{max}	< 11 A per tracker	< max. rated current (DC)

NOTE

If one of the MPP trackers (A or B) is not used, then it must be short-circuited, otherwise faults can occur during the self-test of the unit and the feed-in operation is not guaranteed. The short-circuiting of an unused MPP tracker does not result in the device being damaged.

The recommended standard connection should always be used as a matter of course before an MPP tracker is short-circuited and therefore remains unused.

7.3.4 Connecting the PV generator

DANGER

Risk of fatal injury due to electric shock

Severe injury or death will result if the live connections are touched. When there is solar radiation, DC voltage will be present at the open ends of the DC leads.

› Do not touch the exposed ends of the cables.

› Avoid short circuits.

Connecting the PV generator

1. Remove protective caps from the DC connection plugs.
2. Connect PV generator to the DC plug connectors on the underside of the housing.
3. Ensure that the unused plug connectors are sealed with protective caps.

» The inverter is connected to the PV generator.

7.4 Connecting the interfaces

All interfaces are located on the connection circuit board underneath the cover for the connection area. For connection, use the cable fittings and plug connections provided (see Figure 26 on page 25).

DANGER

Risk of fatal injury due to electric shock

Severe injury or death may result from improper use of the interface connections and failure to observe protection class III.

› The SELV circuits (SELV: safety extra low voltage) can only be connected to other SELV circuits with protection class III.

NOTE

When routing the interface connection cable, note that too little clearance to the DC or AC cables can cause interference during data transfer.

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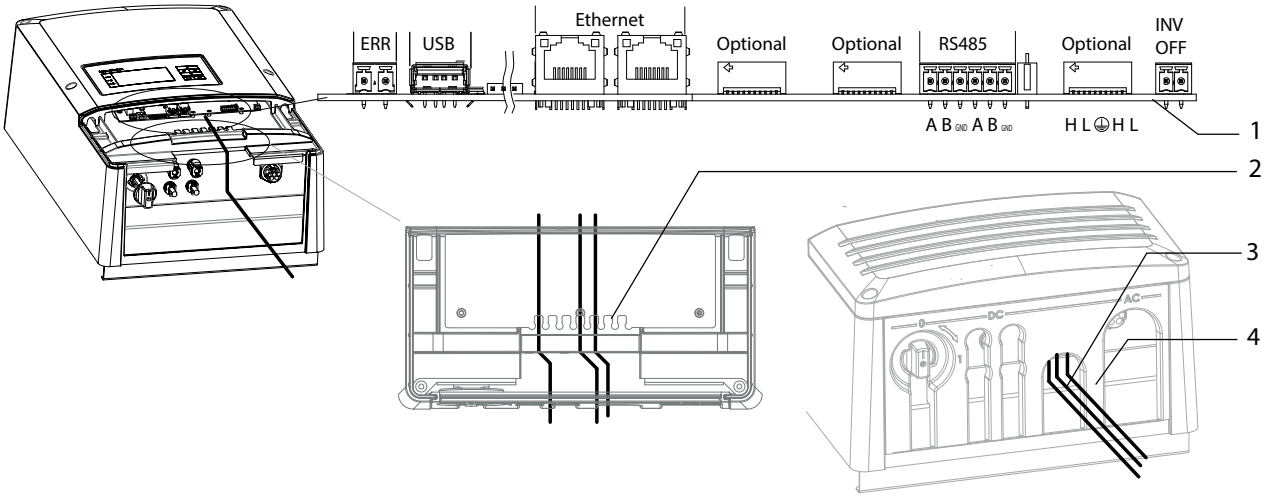

Figure 26: Connection area: Connection and assignment of the interfaces

Key			
1	Interface connections / pin assignment	3	Connection line interfaces
2	Cable anchoring rails with notches for strain relief and fastening the connection lines for the interfaces	4	Slider

7.4.1 Connecting the RS485 bus

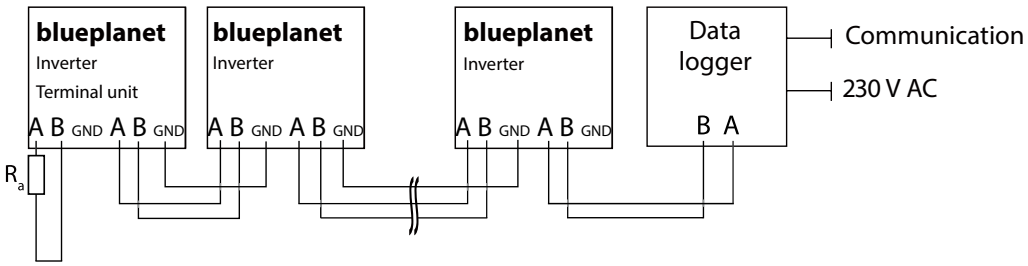

Figure 27: RS485 interface wiring diagram

NOTE

Different manufacturers do not always interpret the standard on which the RS485 protocol is based in the same way. Note that the wire designations (- and +) for wires A and B can vary between manufacturers.

NOTE

Calculating efficiency by measuring the current and voltage values can lead to misleading results due to the tolerances of the measurement devices. The sole purpose of these measured values is to monitor the basic operation of the system.

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Connecting the RS485 bus

☞ To prevent interference during data transmission:

- When connecting wire A (-) and wire B (+), observe the wire pairing (see Figure 28)
- Do not install RS485 bus lines in the vicinity of live DC/AC cables.

1. Unscrew the cable fitting.
2. Thread the connection cables through the cable fitting.
3. Connect the connection cables to the corresponding connection terminals (see Figure 26 on page 25).
4. The following must be connected to all inverters and to the data monitor unit in the same way:
   - Wire A (-) to wire A (-) and
   - Wire B (+) to wire B (+) (see Figure 27 on page 25)
   - GND to GND
5. Tighten the cable fitting.
6. Activate the terminating resistor on the terminal unit.

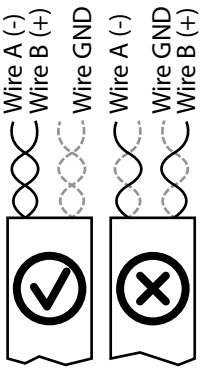

Figure 28: Assignment of twisted-pair wires

7.4.2 Connecting the Ethernet interface

NOTE

Use a suitable network cable of at least category 5. The maximum length of a network segment is 100 m. Ensure that the cable is correctly assigned. The Ethernet connection of the inverter supports auto-sensing. You can use both crossed and 1:1 protectively-wired Ethernet connection cables.

Connecting an Ethernet cable to the inverter

1. Place the line over a notch on the cable anchoring rails (see Figure 26 on page 25).
2. Attach cable ties around the line and notch and tighten gently.
3. Connect the connection cables to one of the corresponding Ethernet interface (see Figure 26 on page 25).
4. Relieve the stress on the line by pressing inwards and tighten the cable tie.

Connecting the inverter to the network

↻ Connect the Ethernet cable to the inverter.
↻ Configure the Ethernet interface in the configuration menu.
☞ Connect the Ethernet cable to the network or a computer.
☞ Configure the Ethernet settings and the web server in the Settings/Network menu.

7.4.3 Connecting the fault signal relay

The contact is designed as an N/O contact and is labelled "Relay" on the circuit board.
Maximum contact load capacity DC: 30 V / 1 A. AC: 250 V/1 A.

Connecting the fault signal relay

1. Place the line over a notch on the cable anchoring rails (see Figure 26 on page 25).
2. Attach cable ties around the line and notch and tighten gently.
3. Attach the connection cables to the connection terminals.
4. Relieve the stress on the line by pressing inwards and tighten the cable tie.

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7.4.4 Connecting "Inverter Off"

EN

NOTE

The Powador-protect digital output can only be used with suitable KACO inverters. When using devices from other manufacturers or in combination with KACO inverters, bus coupler circuit-breakers as a minimum must be used for shutting down devices from other manufacturers.

Connecting and activating "Inverter Off" digital input

↻ Can only be used with suitable KACO inverters.

1. Place the line over a notch on the cable anchoring rails (see Figure 26 on page 25).
2. Attach cable ties around the line and notch and tighten gently.
3. Connect wire A (+) to the terminal marked "INV OFF+" on the first inverter via the "DO1" terminal of the Powador-protect.
4. Connect wire B (-) to the terminal marked "INV OFF-" on the first inverter via the "GND" terminal of the Powador-protect.
5. Connect the other inverters to one another as follows:
   – wire A (+) to wire A (+) and wire B (-) to wire B (-).
6. Relieve the stress on the line by pressing inwards and tighten the cable tie.
7. After commissioning: Activate the support for the Powador-protect in the parameter menu under the "Powador-protect" menu item.

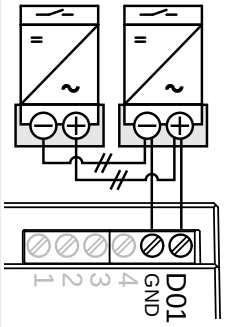

Figure 29: Powador -protect

7.5 Sealing the connection area

1. Insert the slider (see Figure 26 on page 25).
2. Place the connection cover on the connection area of the inverter.
3. Screw in both Torx screws on the front side of the connection cover (blue).

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7.6 Starting up the inverter

DANGER

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

Only appropriately qualified and authorised electricians may start up the inverter.

CAUTION

Risk of burns from hot housing components.

The housing surface and the heat sink can adopt a surface temperature of 75° in operation.

› Do not touch the housing surface or heat sink during and immediately after operation.

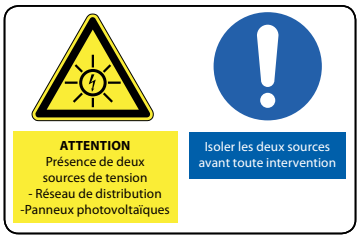
› Allow the device to cool down before touching the housing surface.

FR

Attachment of safety label in accordance with UTE C 15-712-1

The code of practice UTE C 15-712-1 requires that, upon connection to the French low-voltage distribution network, a safety sticker showing a warning to isolate both power sources when working on the device must be attached to each inverter.

☞ Attach the provided safety sticker visibly to the outside of the inverter housing.


ATTENTION
Présence de deux sources de tension
- Réseau de distribution
-Panneux photovoltaïques
Isoler les deux sources avant toute intervention

7.6.1 Switching on the inverter

↻ The inverter has been mounted and electrically installed.

↻ The PV generator supplies a voltage above the configured start voltage.

1. Connect the grid voltage using the external circuit breakers.
2. Connect the PV generator using the DC isolator switch (0 → 1).

» The inverter begins to operate.

» During the initial start-up: Follow the instructions of the New Connection Wizard.

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8 Configuration and Operation

EN

8.1 Controls

The inverter has a backlit LCD as well as three status LEDs. The inverter is operated using six buttons.

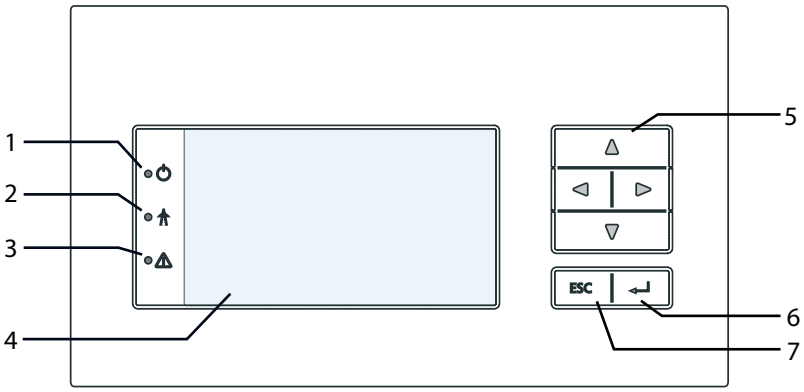

Figure 30: Control panel

Key			
1	"Operating" LED	5	4-way button
2	"Feed-in" LED	6	"OK" button
3	"Fault" LED	7	"ESC" key
4	LCD		

8.1.1 LED indicators

The three LEDs on the front of the inverter show the different operating states.
The LEDs can display the following states:

LED illuminated | LED flashing | LED not illuminated

The LED indicators show the following operating status:

Operating status	LEDs	Display	Description
Start			The green "Operating" LED is illuminated if an AC voltage is present, (independently of the DC voltage).
Feed-in start		Power fed into the grid or measured values	The green "Feed-in" LED is lit. The green "Feed-in" LED is illuminated after the country-specific waiting period*. The inverter is ready to feed in, i.e. is on the grid. You can hear the grid relay switch on.

* The waiting period ensures that the generator voltage continuously remains above the power delivery limit of 150 V.
For country-specific waiting periods see our web site at http://www.kaco-newenergy.de/.

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Operating status	LEDs	Display	Description
Feed-in operation		Power fed into the grid or measured values	The green "Operating" LED is lit. The green “Feed-in” LED is illuminated. The “Feed-in” icon appears on the desktop. The inverter feeds into the grid.
Non-feed-in operation		Status message	The display shows the corresponding message.
Fault		Fault message	The display shows the corresponding message. The red "Fault" LED is illuminated.

8.1.2 Graphical display

The graphical display shows measured values and data and allows the configuration of the inverter using a graphical menu. In normal operation, the backlighting is switched off. As soon as you press one of the control buttons, the backlighting is activated. If no button is pressed for an adjustable period of time, it switches off again. You can also activate or deactivate the backlighting permanently. In sleep mode, the inverter deactivates the display regardless of the selected setting.

NOTE

Depending on the tolerances of the measuring elements, the measured and displayed values are not always the actual values. However, the measuring elements ensure maximum solar yield. Due to these tolerances, the daily yields shown on the display may deviate from the values on the grid operator’s feed-in meter by up to 15%.

After being switched on and after initial commissioning is complete, the inverter displays the start screen (the desktop). If you are in the menu and do not touch the control buttons for two minutes, the inverter returns to the desktop.

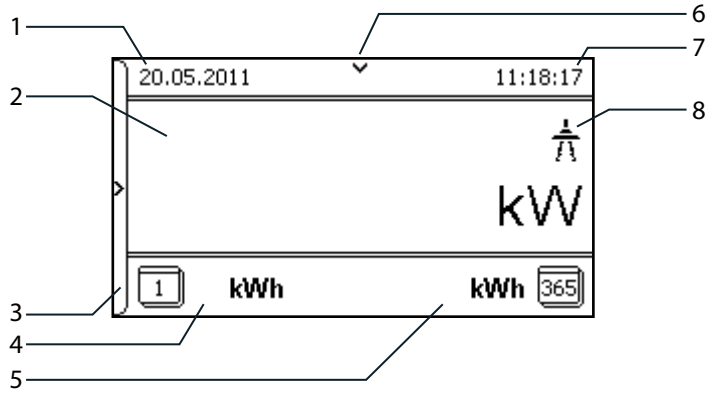


Figure 31: Desktop

Key			
1	Current date	6	Status bar
2	Current power	7	Current time
3	Menu indicator	8	Feed-in indicator
4	Daily yield		
5	Annual yield		

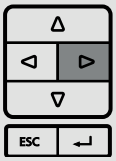
EN

8.1.3 Control buttons

The inverter is operated using the 4-way button and the OK and ESC buttons.

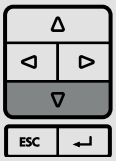
Desktop

Opening the menu



↻ The inverter is operating.
↻ The LCD is showing the desktop.
☞ Press the right arrow button.
» The menu opens up over the desktop from left to right.

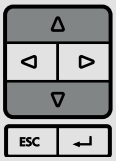
Displaying the daily output



↻ The inverter is operating.
↻ The LCD is showing the desktop.
☞ Press the down arrow button.
» The LCD displays the daily yield in a diagram.
☞ To return to the desktop, press any button.

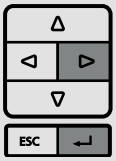
Inverter menu

Navigating through the menu



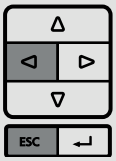
↻ You have left the desktop. The inverter displays the menu.
☞ Use the up and down arrow buttons.

Opening a menu item or a setting



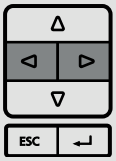
☞ Use the right arrow button and the OK button.

Jump to the next higher menu level/discard changes



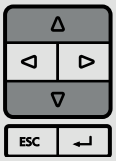
☞ Press the left arrow button or the ESC button.

Opening the parameter menu



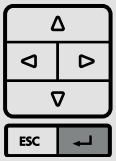
☞ Press the right arrow key and left arrow key simultaneously for 5 seconds.

Changing a parameter/the value of an input field



☞ Use the up and down arrow buttons.

Saving changed settings



☞ Press the OK button.

EN

8.2 Initial start-up

When started for the first time, the inverter displays the configuration assistant. It takes you through the settings necessary for the initial start-up.

NOTE

After configuration is completed, the configuration assistant does not appear again when the inverter is restarted. You can then change the country setting only in the password-protected parameter menu. The other settings can still be changed in the Settings menu.

NOTE

The sequence of the settings required for initial commissioning is preset in the configuration assistant.

Navigation

- ☞ In order to select a setting, press the up and down buttons.
- ☞ To select the next menu item, press the OK button.
- ☞ To return to the most recently selected menu item, press the ESC button.
- ☞ Set the required settings.

Press the OK button in the last menu item.

» You have completed the initial configuration. The inverter begins to operate.

Initial configuration

- ☞ Select the menu language.
- ☞ Select the country of operation with grid type.
- ☞ Set the date and time.
- ☞ To store the set operator country and grid type permanently, confirm these settings with "Yes".

» You have completed the initial configuration. The inverter begins to operate.

8.3 Menu structure

8.3.1 Display on the LCD

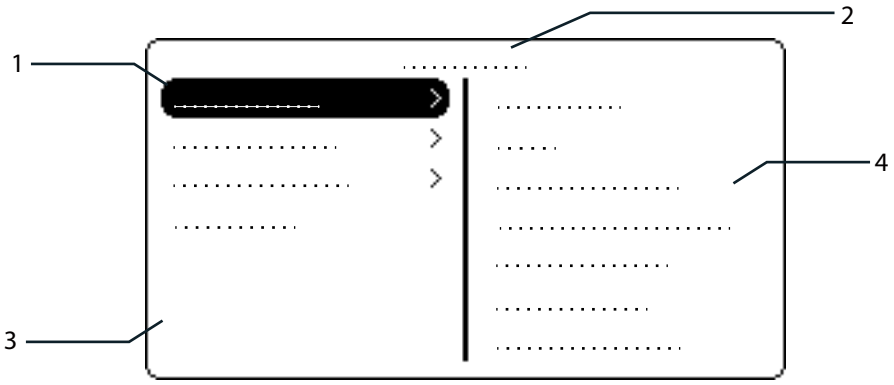


Figure 32: Main menu

Key			
1	Selected menu item	3	Menu items of the active menu level
2	Name of the active menu level	4	Menu items of the next lower menu level

EN

8.3.2 Menu structure

NOTE

The menu items displayed on screen are dependent on the country and network settings, and may vary according to the type of device.

Icons used:

1-2-3-4	Menu level (0, 1, 2, 3)	↳	Submenu available
	Display menu		Password-protected menu
	Option menu		

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
	Desktop	**Desktop**	↳	☞ Press the right arrow button.
	1-2-3-4	**"Measurements" menu**	↳	☞ Open the menu: Press the right arrow button or the OK button.
	1-2-3-4	**Generator**		Displays the DC-side voltage, amperage and power
	1-2-3-4	**Grid**		Displays the AC-side voltage, amperage and power
	1-2-3-4	**Power control**		Displays the current value of the external power limitation by the grid operator.
	1-2-3-4	**cos-phi**		Indicates the status of the idle power control.
	1-2-3-4	**Unit temperature**		Displays the temperature in the inverter housing.
	1-2-3-4	**Yield counter**		Displays the yield in kWh. ☞ Reset the counter using the "Reset" key.
	1-2-3-4	**Yield today**		Displays the cumulative yield for the current day.
	1-2-3-4	**Total yield**		Displays the total yield up to now.
	1-2-3-4	**CO2 savings**		Displays the calculated CO_2 savings (in kg).
	1-2-3-4	**Oper. hrs cntr**		Displays the duration of operation in hours. ☞ Reset the counter using the "Reset" key.
	1-2-3-4	**Oper. time today**		Displays the duration of operation on the current day.
	1-2-3-4	**Total oper. time**		Displays the total operating time.
	1-2-3-4	**Log data display**	↳	☞ Open the menu: Press the right arrow button or the OK button. ☞ Measurement data can be transferred to a USB stick by selecting it and moving it.

EN

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
	1 2 3 4	**Day display**		Displays the recorded operating data graphically. 1. Select the measured value to be displayed. Supported measured values: • Grid power P(grid) • DC power per string P(PV) 1-2 • DC voltage per string U(PV) 1-2 • Unit temperature 2. Select a day. 3. Press the OK button. » The display shows the selected data. ☞ Press any button to return to the previous menu.
	1 2 3 4	**Month display**		Displays the recorded operating data graphically. 1. Select a month. 2. Press the OK button. » The display shows the selected data. ☞ Press any button to return to the previous menu.
	1 2 3 4	**Year display**		Displays the recorded operating data graphically. 1. Select a year. 2. Press the OK button. » The display shows the selected data. ☞ Press any button to return to the previous menu.
	1 2 3 4	**CSV log data**	⮡	☞ Open the menu: Press the right arrow button or the OK button.
	1 2 3 4	**Decimal separator**		☞ Select decimal sign for export of saved operating data.
	1 2 3 4	**Save to USB**		In this menu, you can export the saved operating data to a connected USB flash storage device. ↻ You have connected a USB flash storage device to the inverter. 1. Select the data to be exported (year, month or day). 2. Press the OK button. » The inverter writes the data to a connected USB flash storage device.
	1 2 3 4	**"Settings" menu**	⮡	☞ Open the menu: Press the right arrow button or the OK button.
	1 2 3 4	**Language**		☞ Select the desired language for the user interface.
	1 2 3 4	**Def. total yield**		You can set the total yield to any value, for example, when you have received a replacement unit and want to continue the recording from the present value. ☞ Select the "Save" button and confirm with the OK button.
	1 2 3 4	**Interface**		☞ Assign a unique RS485 bus address to the inverter ("RS485 address" menu item). The address must not be the same as that of any other inverter or a proLOG unit.

EN

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
	1 2 3 4	**S0 pulse rate**		☞ Set the pulse rate of the S0 connection.
	1 2 3 4	**Priwatt**	↳	☞ Open the menu: Press the right arrow button or the OK button.
	1 2 3 4	**Activation mode**		☞ Select operating mode **NOTE:** Re-activation depends on the operating mode selected and on the activation conditions.
	1 2 3 4	**Monitoring time**		☞ Set time span during which the power threshold must be exceeded without interruption.
	1 2 3 4	**Power threshold**		☞ Set power threshold from which the monitoring time up to activation begins.
	1 2 3 4	**Operation mode**		☞ Power-dependent: the function remains active until below the set power threshold. ☞ Time-dependent: The function is active depending on the sunlight for the set operating time.
	1 2 3 4	**Operation time**		**NOTE:** The menu option is only available in the "Time-dependent" operation mode. ☞ After connection, the function is active for the set operating time.
	1 2 3 4	**Quick start**		☞ Reduce the waiting times during the self test by pressing the "Activate" key.
	1 2 3 4	**Logging interval**		☞ Set the time between two log data recordings.
	1 2 3 4	**Log data backup**		The inverter supports the backing up of all recorded yield data to a connected USB storage device. ☞ Activate or deactivate log data backup.
	1 2 3 4	**Display**		☞ Configure the contrast setting for the display. ☞ Set the length of time without user input after which the backlighting of the LCD switches off. ☞ Alternatively: Permanently activate or deactivate the backlighting by selecting "On" or "Off".
	1 2 3 4	**Date & time**		☞ Set the date and time. **NOTE:** For self-diagnostic purposes, the inverter carries out a daily restart at midnight. To avoid having a restart occur during feed-in operation and to always obtain reliable log data, ensure that the time is correctly set.
	1 2 3 4	**Network**	↳	☞ Open the menu: Press the right arrow button or the OK button.
	1 2 3 4	**DHCP**		Activate or deactivate DHCP. ☞ On: Activate DHCP. Once the DHCP server becomes available, the IP address, subnet mask, gateway and DNS server are automatically applied and the aforementioned menu items are hidden. ☞ Off: DHCP deactivated, make settings manually.

EN

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
				NOTE: The "IP address", "Subnet masks", "Gateway" and "DNS server" menu options are only displayed with the DHCP deactivated.
	1 2 3 4	**IP address**		☞ Allocate a unique IPv4 address in the network.
		Subnet mask		☞ Allocate a network mask
		Gateway		☞ Enter IPv4 address of gateway.
		DNS server		☞ Enter IPv4 address of DNS server.
	1 2 3 4	**Web server**		☞ Activate or deactivate the integrated web server. ☞ Set the port at which the web server can be reached.
	1 2 3 4	**Powador-web**		☞ On: The inverter attempts to connect to the Powador-web web portal. ☞ Off: The connection to Powador web is deactivated.
	1 2 3 4	**Modbus TCP**		☞ Activate/deactivate function. ☞ Set network port.
	1 2 3 4	**Connection status**		Indicates the status of the network connection:
	1 2 3 4	**"Parameters" menu**		☞ Press the right arrow button or the OK button. **NOTE:** The inverter does not display the "Parameters" menu in the standard configuration. To display the Parameters menu: 1. Open the menu. 2. Simultaneously hold down the up and down buttons for several seconds.
	1 2 3 4	**Country**		1. Enter the four-digit password using the 4-way button. The password is unit-specific. 2. Confirm the entry with the OK button. 3. Set the desired country setting. **NOTE:** This option influences the country-specific operating settings of the inverter. Please consult KACO service for further information.
DE, FR, GB GR, IT	1 2 3 4	**Grid type/guideline**		☞ Select the grid type for the inverter's installation location.
IT		**Activate self-test**		It is only possible to activate the self-test in feed-in mode. The voltage and frequency dependent shutdown limits are checked in the process.
AT, AU, BE, DE, FR , GB, GR, IT, IL, JO, NL, UD, CY	1 2 3 4	**Grid monitoring**		Offers the option of activating or deactivating three-phase grid monitoring. ☞ Switching the grid monitoring on or off.

EN

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
AU, GR, NL	1 2 3 4	Switch-off volt.		The inverter is equipped with redundant 3-phase monitoring. If the grid frequency exceeds or drops below the configured values, the inverter switches off. The minimum switch-off threshold can be set in 1 V increments. ☞ Configure the switch-off values for undervoltage and overvoltage. ☞ Where necessary, set period from occurrence of the fault to shutdown of the inverter.
AU, FR, GR, IL	1 2 3 4	Switch-off freq.		The inverter continuously monitors the grid frequency. If the grid frequency exceeds or drops below the configured values, the inverter switches off. ☞ Set limit values for underfrequency and overfrequency in 0.1 Hz increments. ☞ Set period from occurrence of the fault to shutdown of the inverter.
DE, BE, FR, IT, AT, CY, UD	1 2 3 4	Overvoltage shutd.		☞ Activate or deactivate password protection. (optional) ☞ Specify the shutdown threshold for overvoltage shutdown. The 10-minute average for the measured voltage as per EN50160 is used. ☞ Set period from occurrence of the fault to shutdown of the inverter.
GB, IL, IT, AT, UD	1 2 3 4	Overvoltage shutd.		☞ Specify the shutdown threshold for fast and slow overvoltage shutdown. ☞ Set period from occurrence of the fault to shutdown of the inverter.
GB, IL, IT, AT, UD	1 2 3 4	Undervoltage shutd.		☞ Specify the shutdown threshold for fast and slow undervoltage shutdown. ☞ Set period from occurrence of the fault to shutdown of the inverter.
FR, UD	1 2 3 4	Voltage drop		The voltage drop between the inverter and the feed-in meter is added to the limit value that was set for grid shutdown according to EN 50160. The limit value can be set from 0 to 11 V in 1 V increments. ☞ Specify the switch-off value for the voltage drop (0 to 11 V).
GB59/3, IT, IL, AT, UD	1 2 3 4	Overfreq. shutd.		☞ Set limit value for overfrequency shutdown.
	1 2 3 4	Underfreq. shutd.		☞ Set limit value for the underfrequency shutdown.
IL, IT, AT, UD	1 2 3 4	Activation condition		The inverter checks mains voltage and frequency. The grid feed operation begins if the measured values are within the set ranges. ☞ Set minimum and maximum values for the switching on.

EN

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
DE, BE, GB, IL, IT, JO, AT, CY, UD	1 2 3 4	**Connect time**		☞ Set period for grid observation (in seconds) when switching on and reconnection after a fault.
IL, IT, UD	1 2 3 4	**P(f) Gradient**		☞ Set gradient of power limit function with increasing frequency in % / Hz. This percentage relates to the nominal frequency of 50 Hz
	1 2 3 4	**P(f) thresholds**		☞ Set the frequency thresholds for activating and deactivating the power limitation in Hz.
DE, AU, BE, FR, GB, GR, IL, IT, JO, NL, AT, CY, UD	1 2 3 4	**DC starting volt.**		The inverter begins feed-in as soon as this DC voltage is present. ☞ Set the starting voltage.
DE, AU, BE, FR, GB, GR, IL, IT, JO, NL, AT, CY, UD	1 2 3 4	**Const. volt. ctrl.**		Lets you deactivate the MPP seek mode in order to operate the inverter with a constant DC voltage. ☞ Activate or deactivate function. ☞ Set value for constant voltage control (125 - 510 V). **NOTE:** For voltages below the minimal MPP voltage the possible input power is reduced. The input current is limited here to 11A per input.
DE, AU, BE, FR, GB, GR, IL, IT, JO, NL, AT, CY, UD	1 2 3 4	**Power limitation**		The output power of the inverter can be set permanently to a lower value than the maximum output power by the internal power limiting. This may be necessary in order to limit the maximum power rating of the system at the grid connection point, upon the grid operator's request. The value can be protected from the very first output limitation entry. After setting a limitation, the value can only be changed by entering a device-specific password. 1. Activate password protection if necessary. 2. Specify the activation status. 3. Specify the limit value for maximum feed-in power. 4. Confirm the entry with the OK button.
DE, AU, BE, FR, GB, GR, IL, IT, JO, NL, AT, CY, UD	1 2 3 4	**Powador-protect**		Configures the support for grid shutdown by a Powador protect connected to the digital input of the inverter. ↻ For Auto/On: A Powador protect is operating in the photovoltaic system and is connected to the inverter at the digital input/output. ☞ Auto: The inverter automatically detects a Powador-protect integrated into the photovoltaic system. ☞ On: The digital signal of the Powador protect must be present to the digital input of the inverter for the inverter to start with feed-in. ☞ Off: The inverter does not check whether a Powador-protect is integrated into the PV system.
DE, AU, BE, FR, GB, GR, IL, IT, JO, NL, AT, CY, UD	1 2 3 4	**Iso.resistor**		☞ Set threshold value (in 1 kOhm steps) at which the insulation monitor reports a fault.

EN

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
AT, UD	1 2 3 4	FRT		The inverter supports dynamic grid stabilisation (Fault Ride-Through). The following parameters can be set: ☞ Operation mode ☞ Dead band ☞ Dead band mode ☞ Constant k ☞ Dynamic blind current
DE, BE, GB, IL, IT, JO, AT, CY, UD	1 2 3 4	Reactive power	↳	☞ Open the menu: Press the right arrow button or the OK button. ☞ Activating idle power process: select process and press OK. The active process is highlighted.
	1 2 3 4	cos-phi specification		☞ Configure power factor. ☞ If a power factor not equal to 1 is selected: Select the type of phase shift (under-excited/over-excited).
DE, BE, GB, IL, IT, JO, AT, CY, UD	1 2 3 4	cos-phi(P/Pn)	↳	☞ Open the menu: Press the right arrow button or the OK button.
GB, IL, IT, JO, AT, UD	1 2 3 4	Q const.		☞ Set the idle power Q (in %) to a fixed value. ☞ Select the type of phase shift (under-excited/ over-excited).
GB, IT, JO, CY	1 2 3 4	Lock-in voltage		☞ Voltage range set as % of rated voltage, where the network support process is active.
	1 2 3 4	Lock-out voltage		
DE, BE, GB, IL, IT, JO, AT, CY, UD	1 2 3 4	Number of nodes		This option defines how many support points can be defined in the subsequent menu. The maximum number of configurable support points depends on the selected grid type. ☞ Specify the number of support points for the idle power characteristic curve.
	1 2 3 4	1., 2. ...Support point		☞ Specify the power factor for the 1st, 2nd (etc.) support point ☞ If a power factor not equal to 0 is selected: Select the type of phase shift (under-excited/over-excited).
GB, IT, JO, AT, UD	1 2 3 4	Q(U) 5 Supports	↳	☞ Open the menu: Press the right arrow button or the OK button.
	1 2 3 4	Lock-in power		☞ Power range set as % of rated power, in which the network support process is active.
	1 2 3 4	Lock-out power		
	1 2 3 4	Time constant		☞ Set the response speed of the control.
GB, IT, JO, AT, UD	1 2 3 4	Number of support points		☞ Specify the number of support points for the idle power characteristic curve.
	1 2 3 4	1., 2. ...Support point		☞ Specify the support points for voltage, power and nature of the phase shift

EN

Country -spec. setting	menu level	Display/ setting		Action in this menu/meaning
GB, IT, JO, UD	1 2 3 4	**Q(U) 2-point**	↳	☞ Open the menu: Press the right arrow button or the OK button.
	1 2 3 4	**Lock-in power**		☞ Power range set as % of rated power, in which the network support process is active.
	1 2 3 4	**Lock-out power**		
	1 2 3 4	**Time constant**		☞ Set the response speed of the control.
	1 2 3 4	**1.-4. Support point**		☞ Specify the support points for voltage, power and nature of the phase shift
DE, BE, CY	1 2 3 4	**Line error**		Display of grid faults. ☞ To show the last 5 grid fault messages, select the "Display" key.
DE, GB, JO, AT	1 2 3 4	**Protection parameters**		Display of essential protection parameters. ☞ To show the protection parameters, select the "Display" key.
IT	1 2 3 4	**SPI**		☞ Provides the option of activating or configuring the specific "System Protection Interface" for Italian. (Additional PCB required!)
	1 2 3 4	**"Information" menu**		☞ Open the menu: Press the right arrow button or the OK button.
	1 2 3 4	**Inv. type**		Displays the type designation of the inverter. If feed-in power is actively limited: display maximum power in kW.
	1 2 3 4	**SW version**		Displays the installed software version.
	1 2 3 4	**Serial no.**		Displays the serial number of the inverter.
	1 2 3 4	**Display country**		Displays the selected country setting. Optional: Displays the grid type if a grid type has been selected.
	1 2 3 4	**"Manufacturer" menu**	↳	The display shows information about the unit manufacturer.

8.4 Monitor inverter

The inverter has an integrated web server. This makes it possible to monitor and record the operating state and yield of your PV system.

You can display the recorded data using:

- The integrated LCD
- The integrated web server using an Internet-capable device connected to the Ethernet interface of the inverter

You can read the recorded data using a storage medium connected to the USB interface of the inverter, e.g. a USB stick.

EN

8.4.1 USB interface

Use an external USB storage device to read operating data saved in the inverter.

Reading log data

NOTE

The USB interface is approved solely for use with USB flash storage devices (“USB sticks”). The maximum available current is 100 mA. If a device with a higher power requirement is used, the power supply for the USB interface automatically shuts down to protect the inverter from damage.

Reading log data

1. Connect a suitable USB storage device to the USB interface on the underside of the inverter.
2. Open the “Log data display” menu.
3. Select the “Save to USB” item.
4. Select the desired log data using the 4-way button.
5. Press the OK button.

» The inverter saves the selected log data to the USB storage device.

8.4.2 Web server

The inverter has an integrated web server. After configuring the network and activating the web server in the Settings menu, you can open the web server from an Internet browser. The language version of the website delivered by the web server is adapted dynamically to the pre-set language preferences in your Internet browser. If your Internet browser requests a language that is unknown to the inverter, the web server uses the menu language set in the inverter.

Setting up the web server

Configuring the Ethernet interface

↻ You have connected the inverter to your network.

1. Open the Settings/Ethernet menu.
2. Assign a unique IP address.
3. Assign a subnet mask.
4. Assign a gateway.
5. Save your settings.

Using the web server

To avoid problems with incompatibility, use the most recent version of your Internet browser. JavaScript must be enabled in the browser settings to display the web server correctly.

NOTE

You can also access the web server of the inverter via the Internet. To do this, additional settings of your network configuration, particularly your Internet router, are required.

Note that communication with the inverter is carried out over an unsecured connection, particularly in the case of a connection over the Internet.

EN

Calling up the web server

↻ Configure the Ethernet interface.

↻ Connect the Ethernet interface.

1. Open an Internet browser.
2. In the address field of the Internet browser, enter the IP address of the inverter and open the site.

» The Internet browser displays the start screen of the web server.

After it has opened, the web server displays information about the inverter as well as the current yield data. The web server enables the following measurement data and yield data to be displayed:

- Feed-in power
- Status
- Grid power
- Grid voltage
- Generator power
- Generator voltage
- Unit temperature

In order to display and export yield data, proceed as follows:

Select the display period

1. Open the web server.
2. Select the display period by choosing either daily view, monthly view, yearly view or overview.

Filtering display data (daily view only)

1. Open the web server.
2. Select daily view.
3. To show or hide measured values, select or deselect the corresponding checkboxes in the "Select display" area.

Exporting data

1. Filter the display data if necessary.
2. Select the display period if applicable (daily, monthly, yearly or overview).
3. Click the "Export data" key.
4. Save the file.

NOTE

Regardless of the display data selected in the "Select display" area, an export file always contains all measurement data and yield data available for the selected period.

8.5 Performing the software update

You can update the software of the inverter to a new version using the integrated USB interface. Use a FAT32-formatted USB stick to do this. Do not use any storage media with an external power supply (for example: an external hard disk).

NOTE

Ensure that the power supply of the AC and DC sides is active. It is only possible to update all components of the inverter to the most current software version in this operating state.

EN

CAUTION

Damage to the inverter

The update can fail if the power supply is interrupted during the update process. Parts of the software or of the inverter itself can then be damaged.

» Do not interrupt the DC and AC power supply during the update process.

» Do not remove the USB stick during the update process.

Preparing for the software update

1. Download the software update file from the KACO web site and store it on your hard disk.
2. Extract the update file (.KUF) completely onto the USB stick.

» Perform software update.

Performing the software update

↻ Prepare for the software update.

↻ Ensure the supply of DC and AC power.

1. Connect the USB stick to the inverter.

» The message "Software found. Would you like to load it?" appears on the display.

2. If you would like to perform the update, select the "Yes" button.

» The inverter begins the update.

The update can take several minutes. The "Operating" LED flashes during the update process. The inverter may restart several times. The update has been imported in full once the "Software update successful" message appears. Confirm using the Enter key. The inverter then returns to feed-in mode.

9 Maintenance/Troubleshooting

9.1 Visual inspection

Inspect the inverter and the cables for visible damage and note the operating status display of the inverter. In case of damage, notify your installer. Repairs may only be carried out by authorised electricians.

NOTE

The inverter should be checked for proper operation by a qualified electrician at regular intervals.

9.2 Cleaning

DANGER

Lethal voltages in the inverter

Serious injuries or death may occur if moisture gets into the inverter.

› Only use completely dry objects to clean the inverter.

› Only the exterior of the inverter should be cleaned.

Cleaning the inverter

☞ Do not use compressed air.

☞ Use a vacuum cleaner or a soft brush to remove dust from the fan cover, between the cooling fins and from the top side of the inverter on a regular basis.

☞ Remove dust from the ventilation inlets if necessary.

☞ If necessary, remove the fan cover and remove deposits.

EN

Authorised electrician

9.3 Shutting down for maintenance and troubleshooting

DANGER

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

When there is solar radiation, DC voltage will be present at the open ends of the DC leads. Arcing may occur if the DC cables are disconnected while they are still live.

Only appropriately qualified and authorised electricians may open and maintain the inverter.

› Observe all safety regulations and the current technical connection specifications from the relevant power supply company.
› Disconnect the AC and DC sides.
› Secure the AC and DC sides from being inadvertently switched back on.
› Do not touch the exposed ends of the cables.
› Avoid short circuits.
› Do not open the inverter until these two steps are complete.
› After shutdown, wait at least 30 minutes before working on the inverter.

CAUTION

Destruction of the DC connection

The connection terminals can be destroyed by arcing if disconnected while still live.

› It is absolutely essential that the shutdown sequence is carried out in the correct order.

Shutting down the inverter

1. Switch off the grid voltage by turning off the external circuit breakers.
2. Disconnect the PV generator using the DC isolator switch.

DANGER! The DC cables are still live.

☞ Ensure that there is no voltage present on the grid connection terminals.

9.4 Faults

9.4.1 Procedure

DANGER

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

☞ When a fault occurs, notify an appropriately authorised and qualified electrician or KACO new energy GmbH Service.

☞ The operator can only carry out actions marked with a B.

☞ In case of power failure, wait for the system to automatically restart.

☞ Notify your electrician if there is an extended power failure.

B = Action of the operator

E = The indicated work may only be carried out by an authorised electrician.

K = The indicated work may only be carried out by a service employee of KACO new energy GmbH.

EN

9.4.2 Troubleshooting

Fault	Cause of fault	Explanation/remedy	By
The display is blank and the LEDs do not light up.	Grid voltage not available	☞ Check whether the DC and AC voltages are within the permitted limits (see Technical Data).	E
		☞ Notify KACO Service.	E
The inverter stops feeding into the grid shortly after being switched on, even though there is sunlight present.	Faulty grid separation relay in the inverter.	If the grid separation relay is defective, the inverter will recognise this during the self-test.	
		☞ Ensure that there is sufficient PV generator power.	E
		☞ If the grid separation relay is defective, have it replaced by KACO Service. ☞ Notify KACO Service.	K
The inverter is active but is not feeding into the grid. The display indicates a line failure.	Grid-feed is interrupted due to a grid fault.	Due to a grid fault (grid impedance too high, over/undervoltage, over/underfrequency), the inverter stopped the feed-in process and disconnected from the grid for safety reasons.	
		☞ Change the line parameters within the permitted operating limits (see the "Start-Up" section).	E
The grid fuse trips.	The grid fuse capacity is too low.	In cases of high solar radiation, the inverter exceeds its rated current for a short period, depending on the PV generator.	
		☞ Select the capacity of the inverter's pre-fuse to be somewhat higher than the maximum feed-in current (see the "Installation" section).	E
		☞ Contact the grid operator if the grid failure continues to occur.	E
The grid fuse trips.	Damage to the inverter's hardware.	If the line fuse trips immediately when the inverter goes into feed-in mode (after the start-up period is complete), the inverter's hardware is probably damaged.	
		☞ Contact KACO Service to test the hardware.	E
The inverter displays an impossible daily peak value.	Faults in the grid.	The inverter continues to operate as normal without losses to the yield, even when an erroneous daily peak value is displayed. The value is reset overnight.	
		☞ To reset the value immediately, switch the inverter off by disconnecting it from the grid and switching off the DC, then switch it back on.	E
Daily yields do not correspond to the yields on the feed-in meter.	Tolerances of the measuring elements in the inverter.	The measuring elements of the inverter have been selected to ensure maximum yields. Due to these tolerances, the daily yields shown may deviate from the values on the feed-in meter by up to 15%.	
		☞ No action	-

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Fault	Cause of fault	Explanation/remedy	By
The inverter is active but is not feeding into the grid. Display: "Waiting for feed-in"	• Generator voltage too low • Grid voltage or PV generator voltage unstable.	• The PV generator voltage or power is not sufficient for feed-in (solar radiation is too low). • The inverter checks the grid parameters before the feed-in process begins. The length of time it takes to switch back on again differs by country according to applicable standards and regulations and can take several minutes. • The starting voltage may have been set incorrectly.	
		☞ Adjust starting voltage in the Parameter menu if required.	**E**
Noise emission from the inverter.	Particular ambient conditions.	When there are certain ambient conditions, the units may emit audible noises. • Grid interference or grid failure caused by particular loads (motors, machines, etc.) which are either connected to the same point on the grid or located in the vicinity of the inverter. • In cases of volatile weather conditions (frequent switching between sunny and cloudy conditions) or strong solar radiation, a light hum may be audible due to the increased power. • Under certain grid conditions, resonances may form between the unit's input filter and the grid, which may be audible even when the inverter is switched off. These noise emissions do not affect the operation of the inverter. They do not lead to loss of efficiency, failure, damage or to a shortening of the unit's service life. People with very sensitive hearing (particularly children) are able to hear the high-frequency hum caused by the inverter's operating frequency of approximately 17 kHz.	
		☞ No action	
In spite of high radiation levels, the inverter does not feed the maximum power into the grid.	The device is too hot and the system limits the power.	Because the temperatures inside the unit are too high, the inverter reduces its power to prevent damage to the unit. Note the technical data. Ensure that the convection cooling is not impeded from the exterior. Do not cover the cooling fins.	
		☞ Ensure sufficient cooling of the unit. ☞ Do not cover the cooling fins.	**B, E**

9.5 Messages on the display and the "Fault" LED

Many fault signals indicate a fault in the grid. They are not operational faults of the inverter. The triggering levels are defined in standards, e.g. VDE0126-1-1. The inverter shuts down if the values exceed or fall below the approved levels.

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9.5.1 Display of status and fault messages

Display	Fault LED (red)		
FS (fault status)	● ⚠	**ON**	• Fault signal relay has switched. • Feed-in was ended due to a fault.
OS (operating status)	○ ⚠	**OFF**	• The fault signal relay releases again. • The inverter feeds back into the grid again after a country-specific time period.

Details regarding the fault or operating status can be found either on the display or in the data that was recorded through the RS485 interface.

Status and fault signals

The following table lists the possible status and fault signals that the inverter shows on the LCD and the LEDs.

BS = operating status, FS = fault status;

B = Action of the operator

E = The indicated work may only be carried out by an authorised electrician.

K = The indicated work may only be carried out by a service employee of KACO new energy GmbH.

Status		Display	⏚	⚠	Explanation	Action	
OS	1	Waiting for feed-in	○	○	Self-test: The grid parameters and generator voltage are being checked.	-	-
OS	2	Generator voltage too low	○	○	Insufficient generator voltage and power, status before the transition to night shutdown	-	-
OS	8	Self-test	○	○	Checks the shutdown of the power electronics as well as the grid relay before feed-in mode.	-	-
FS	10	Temperature in unit too high	○	●	In case of overheating, the inverter switches off. Possible causes: • Ambient temperature too high, • Fans covered, • Inverter defective.	☞ Cool off the area around the inverter. ☞ Uncover the fans. ☞ Notify your authorised electrician.	**B** **B** **E**
OS	11	Measured values	●	○	Power limitation: If the generator power is too high, the inverter limits itself to the maximum power (e.g. around noon if the generator capacity is too large).		
FS	17	Shutting down Powador-protect	○	●	The activated grid and system protection has been tripped.	☞ Wait for reactivation. ☞ Notify your authorised electrician if the fault occurs several times.	**E**
FS	18	Resid. current shutdown	○	●	Residual current was detected. The feed-in was interrupted.	☞ Notify your authorised electrician.	**E**
FS	19	Generator insulation fault	○	●	There is an insulation fault on the PV generator. The feed-in was interrupted.	☞ Notify your authorised electrician if the fault occurs several times.	**E**

Table 3: Operating status and fault messages on the display

EN

Status		Display			Explanation	Action	
FS	21	Protective shut-down PV current 1	○	●	DC current has exceeded the permissible maximum value on PV1 or PV2. A shutdown is carried out to protect the device.	☞ PV generator may be over-dimensioned.	**B**
FS	22	Protective shut-down PV current 2	○	●			
FS	29	DC side ground fault	○	●	A ground fault was detected on the DC side.	☞ Check the PV generator after ground fault.	**E**
FS	32	Fault Self-test	○	●	The internal grid separation relay test has failed.	☞ Notify your authorised electrician if the fault occurs several times.	**E**
FS	33	Fault DC feed-in	○	●	The DC feed-in has exceeded the permitted value. This DC feed-in can be caused by grid conditions and may not necessarily indicate a fault.	☞ Notify your authorised electrician if the fault occurs multiple times.	**E**
FS	35	Protection shut-down SW	○	●	Protective shutdown of the software (AC overvoltage, AC overcurrent, DC link overvoltage, DC overvoltage, DC overtemperature).	Not a fault Grid-related shutdown, the grid connects again automatically.	
FS	37	Unknown hardware	○	●	Device does not detect expansion hardware.	☞ Additional hardware faulty or not original KACO accessories!	**B**
FS	38	Generator overvoltage error	○	●	The voltage of the DC generator is too high. The PV generator is configured incorrectly.	☞ Notify your authorised electrician.	**E**
FS	41 42	Line failure: Under voltage L1, Over voltage L1,	○	●	The voltage of a grid phase is too low; the grid cannot be fed into. The phase experiencing failure is displayed.	☞ Notify your authorised electrician.	**E**
	43 44	Under voltage L2, Over voltage L2,					
	45 46	Under voltage L3, Over voltage L3,					
FS	47	Grid failure: phase-to-phase voltage	○	●	The measured line-to-line voltage is outside of the tolerance limits.	☞ Notify your authorised electrician.	**E**
FS	48	Line failure: Underfrequency	○	●	Grid frequency is too low. This fault may be grid-related.	☞ Notify your authorised electrician.	**E**
FS	49	Line failure: Overfrequency	○	●	Grid frequency is too high. This fault may be grid-related.	☞ Notify your authorised electrician.	**E**
FS	50	Line failure: average voltage	○	●	The grid voltage measurement according to EN 50160 has exceeded the maximum permitted limit value. This fault may be grid-related.	☞ Notify your authorised electrician.	**E**
FS	51 53	Grid failure: average voltage L1 / L2	○	●	String voltage L1 / L2 is above the set maximum permissible string voltage	☞ Notify your authorised electrician.	**E**

Table 3: Operating status and fault messages on the display

EN

Status		Display			Explanation	Action	
FS	52 54	Grid failure: mid-undervoltage L1 / L2	○	●	String voltage L1 / L2 is below the set maximum permissible string voltage	☞ Notify your authorised electrician.	**E**
FS	57	Waiting for reactivation	○	●	Waiting time of the inverter after a fault.	Inverter does not switch on again until the country-specific time has elapsed.	
FS	58	Overtemperature Control card	○	●	The temperature inside the unit was too high. The inverter switches off to prevent damage to the hardware.	☞ Provide for sufficient ventilation.	**E**
OS	60	Generator voltage too high	○	●	The inverter does not begin feeding into the grid until the PV voltage falls below a specified value.	-	-
OS	61	External limit (%)	✳	○	The external limit *Power control* was activated by the grid operator. The inverter limits its power.		
OS	63	Measured values	●	○	P(f)/frequency-dependent power reduction: Frequency-dependent power reduction will be activated when the BDEW (German Association of Energy and Water Industries) Medium Voltage Directive goes into effect. Power reduction starts at a frequency of 50.2 Hz.		
OS	64	Measured values	●	○	Output current limiting: The AC current is limited once the specified maximum value has been reached.		
FS	70	Fan error	●	○	The fan is malfunctioning.	☞ Replace defective fan	**E**
OS	74	External idle power requirement	✳	○	The grid operator limits the feed-in power of the inverter.	-	-
FS	78	Resid. current shut-down (AFI)	○	●	The integrated AC/DC-sensitive residual current device registered an non-permissibly high leakage current going to PE.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
OS	79	Insulation measurement	○	○	PV generator's insulation is being measured	-	**-**
FS	81, 82, 83	Protection shut-down line volt. L1 L2, L3	○	●	Overvoltage has been detected on a conductor. An internal protective mechanism has disconnected the device to protect it against damage.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	84	Protection shut-down undervolt. DC link	○	●	A voltage deviation has been found in the DC link. An internal protective mechanism has disconnected the device to protect it against damage.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	85	Protection shut-down overvolt. DC link	○	●			**E**
FS	87	Protect. shutdown overcurrent L1	○	●	A current that has been found on a conductor is too high. An internal protective mechanism has disconnected the device to protect it against damage.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	97	Protection shut-down overcurrent HW	○	●	Too much power has been fed into the grid. Complete disconnection of the device.	☞ Notify authorised electrician / KACO Service	**E/K**

Table 3: Operating status and fault messages on the display

EN

Status		Display			Explanation	Action	
FS	100	Protect. shutdown HW overheating	○	●	The device has been switched off because the temperatures in the housing were too high.	☞ Check to make sure that the fans are working. ☞ Replace fan if necessary.	**B** **E**
FS	101 to 106	Temperature plausibility error, efficiency, DC link, AFI module, relay, DC/DC converter	○	●	The unit has shut down because of implausible internal measured values.	☞ Notify KACO Service	**K**
FS	125	AC relay error relay control	○	●	Release signal for the relay control is fed back. The shutdown is carried out if the level is incorrect.	☞ Notify KACO Service	**K**
FS	131 132	Arc detected on DC1 / DC2	○	●	Arc or other external influences generate an interference spectrum. Possible cause: Incorrect connectors, faulty cables or modules.	☞ Check the system ☞ Error reset possible via menu option.	**E** **B**
FS	134	AFCI power supply critical	○	●	Supply voltage of the AFCI is outside the tolerance.	☞ Notify KACO Service	**K**

Table 3: Operating status and fault messages on the display

10 Service

If you need help solving a technical problem with one of our KACO products, please contact our service hotline.

Please have the following information ready so that we can help you quickly and efficiently:

- Device name / serial number
- Date of installation / Start-up report
- Fault message shown on the display / Description of the fault / Did you notice anything unusual? / What has already been done to analyse the fault?
- Module type and string circuit
- Consignment identification / Delivery address / Contact person (with telephone number)
- Information about the accessibility of the installation site.
  Any additional costs arising from unfavourable structural or mounting conditions shall be billed to the customer.

You can find the following items and other information at our web site http://www.kaco-newenergy.de/:

- our current warranty conditions,
- a complaint form,
- a form for registering your device with us. Please register your unit without delay. In this manner, you can assist us in providing you with the quickest service possible.
  Note: The maximum length of the warranty is based on the currently applicable national warranty conditions.

Hotlines

	Technical troubleshooting	Technical consultation
Solar PV Inverters / Energy Systems Technology	+49 (0) 7132/3818-660	+49 (0) 7132/3818-660
Solar PV Accessories	+49 (0) 7132/3818-690	+49 (0) 7132/3818-690
Customer help desk	Monday to Friday from 8:00 a.m. to 5:00 p.m. (CET)	

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11 Shutdown/Disassembly

11.1 Shutdown

DANGER

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

When there is solar radiation, DC voltage will be present at the open ends of the DC leads. Arcing may occur if the DC cables are disconnected while they are still live.

- It is essential that the shutdown sequence is carried out in the correct order.
- After shutdown, wait at least 30 minutes before working on the inverter.
- When working on photovoltaic modules, in addition to disconnecting from the grid, always disconnect the DC main switch on the generator junction box at all poles (or the DC plug connectors). Disconnecting the grid voltage is not enough.

CAUTION

Risk of burns from hot housing components.

The housing surface and the semiconductor can adopt a surface temperature of 75° in operation.

- Do not touch the housing surface or semiconductor during and immediately after operation.
- Allow the device to cool down before touching the housing surface.

Shutdown sequence

1. Switch off the grid voltage by turning off the external circuit breakers.
2. Disconnect the PV generator using the DC isolator switch.

DANGER! The DC cables are still live.

☞ Ensure that there is no voltage present on the grid connection terminals.

11.2 Uninstallation

↻ Shut down the inverter.

1. Open the connection area.
2. Remove the interface cable.
3. Detach DC connection plug.
4. Detach AC connection plug.
5. Unfasten cable ties.
6. Pull out the cables.

» The uninstallation of the inverter is complete. Continue with the disassembly.

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11.3 Disassembly

↻ Shut down the inverter.
↻ Uninstall the inverter.
1. Unfasten the screw securing the inverter.
2. Remove the inverter from the mounting screws.
3. Securely pack up the inverter if it is to be used later
   or
   have the inverter disposed of professionally.

12 Disposal

For the most part, both the inverter and the corresponding transport packaging are made from recyclable raw materials.

Unit: Do not dispose of faulty inverters or accessories together with household waste. Ensure that the old unit and any accessories are disposed of in a proper manner.

Packaging: Ensure that the transport packaging is disposed of properly.

EN

13 EU Declaration of Conformity

Manufactorer's name and address	**KACO new energy GmbH** Carl-Zeiss-Straße 1 74172 Neckarsulm, Germany
Product description	**Photovoltaic feed-in inverter**
Type designation	**KACO blueplanet 3.0 TL1 / KACO blueplanet 3.5 TL1** **KACO blueplanet 3.7 TL1 / KACO blueplanet 4.0 TL1** **KACO blueplanet 4.6 TL1**

This is to confirm that the units listed above comply with the protection requirements set forth in the Directive of the Council of the European Union of 15th December 2004 on the harmonisation of the laws of the member states relating to Electromagnetic Compatibility (2004/108/EC) and the Low Voltage Directive (2006/95/EC).

The units conform to the following standards:

2006/95/EC "Directive relating to electrical equipment designed for use within certain voltage limits"	**Safety of the unit** IEC 62109-1:2010 IEC 62109-2:2011
2004/108/EC "Directive relating to electromagnetic compatibility"	**Interference immunity** EN 61000-6-1:2007 EN 61000-6-2:2005 **Emitted interference** EN 61000-6-3:2007 + A1:2011 **Secondary effects on the grid** EN 61000-3-2:2006* + A1:2009 + A2:2009 EN 61000-3-3:2008* EN 61000-3-11:2000** EN 61000-3-12:2011** * valid for device types with a rated current ≤ 16 A ** valid for device types with a rated current ≥ 16 A

The types mentioned above are therefore labelled with the CE mark.

Unauthorised modifications to the supplied units and/or any use of the units that is contrary to their intended use render this Declaration of Conformity null and void.

Neckarsulm, 28/10/2014
KACO new energy GmbH

p.p. Matthias Haag
Member of the Executive Board for Technology / CTO

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The text and figures reflect the current technical state at the time of printing. Subject to technical changes. No liability for printing errors.

KACO new energy.

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